XI2000 mcu development system

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Attention: Whether you're a novice or expert, please spend at least one hour to read this manual carefully.

Chapter I: XL2000 integrated single-chip simulation system

1.1 System

XL2000 comprehensive experimental system (shorts for XL2000) is a multi-functional 8051 MCU development platform (partly supporting AVR/PIC family chips) which is developed by Xuelin Electronic Co. Shenzhen, China. The company has more than 10 years of experience on embedded system designing and manufacturing around 8051 MCU family chips. XL2000 combines not only the peripheral hardware often seen on other similar product, also ISP downloading wires, MCU programmer, debugger and simulator all in one board. With the assistant of hundreds of short and real runnable C language programming examples, you could learn the programming technology comprehensively in the shortest time. It is especially suitable for beginners, college students and embedded engineers.

In particular:
What are the features of XL2000? What can we do with it? It is integrated more than 30 full-opening hardware modules with powerful functionality. You can configure and active them as you wish.

CP2102 All USB communication	12846 Chinese LCD (Optional)	8-bit LED	8-bit digital tube display
89C2051 The core monitoring	1602 Character LCD screen	74LS165 Into a string	74SL47 LED decoding
ADC 0804 Analog - digital	93C46 EPROM	74ls138 Decoder	A relay output
Dac 0832 Digital-Analog	24C02 Serial EPROM	74LS164 Into a string	8 DIP switches
16 * 16, Matrix switch button	Small alarm bell	74LS14 Reverse-	4 button switch
Single-chip simulation	Infra-red remote control	Stepping Motor	NE555 Hardware oscillator
DS1302 Real-time clock	PS2 Experimental keyboard	Crystal freedom of choice	Single-chip on-line programmingISP+ISP
8155 IOExperimental expansion'	12864 Chinese standard LCD	max 485 Communications	sd card modules
MAX232 Serial Communication	16*16 Chinese dot-matrix screen	Mcp2551 can be reserved bus	18B20 Digital temperature collector

The XL2000 features:
1. Entirely open mold designing:
What is the entirely open mode? All hardware resources are open for users. They are not pre-connected on the board. You can combine various hardware resources into a simple working embedded system as you wish. You have the most flexibility to configure the

hardware and programming on it. For example, when you are writing a marquee program, you can write P1 port or P2 port without any limitation on the hardware pre-connection. You only need to change the connecting wires of the system. By this way, you are not limited by the pre-connection among the hardware resources and have more intuitive feeling about how the software is controlling the hardware deeply. Actually XL2000 is the only development board which supports entirely open designing in the market.

2 high-quality technology:
This experimental box employs transparent Jacques power panels, with aluminum alloy containers, made by machines with surface mount technology. The workmanship is fabulous.

3. Super powerful hardware resources configuration:
It integrates almost all the possible functional module parts oriented to the real application of this 8051 MCU. You do not need to find other components and it should be very helpful for your development task.

4. Perfect sample programming examples:
With more than 10 years of 8051 developing and designing, we are offering programming examples for each hardware module on the board. In addition to the sample code, we are also providing step by step instructions, principle pictures and connecting method. We hope our effort could speed your learning and developing embedded system.

5. USB communication connectors:
USB communication connectors could be used for ISP downloading and also power supplying. It is not necessary to supply the board with an extra external power. It facilitates the laptop users who have not LPT or COM port on his laptop. The single wire connection makes it extremely simple and suit for debugging on the field.

6. anti-plug-protection:
All plugs are designed to prevent wrong plug-in. With connection pictures and clear instructions, it is convenient for your learning even if you are a beginner.

7. More ISP downloading options:
You could choose either RS232 or USB for the communication between the development board and the host PC. The communication is controlled by a separate 89C 2051 which removes the impact on the host PC/OS and improves the stability. The communication could be used as an independent ISP downloading interface for 51/AVR/PIC family ships. Also, it could be used as an independent programming interface for 89S51/52 etc. chips.

8. Equipped with 40pin simulator head:
It could be used as an independent simulator for 51 MCU. With the help of KEIL software, it supports on-line debugging like single step execution, break point and full run.

9. Unique intelligent single click design in software:

You can finish the erasing, writing, verification and running by a single click. It is very helpful for the real programming and reducing the unnecessary debugging time. For example, by the verification step, you are confident your code is really written into the chip. So you can locate connection issue or logical issue in the code quickly when there is something wrong. It is also suitable for international users with our offering of English software version. It is specially equipped with a 3in 1 public plug which supports burning, running and simulating. It is convenient and not need to plug and unplug here and there.

System requirements:

WINDOWS98/ME/2000/XP/2003 operation system, if English OS, must be configured with Chinese character set.

Minimum 50MB space in hard disk.

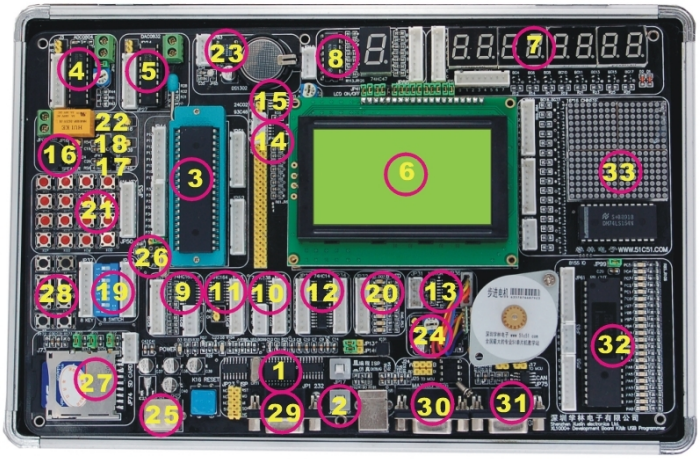
At least one USB port or RS232 serial port

Step by step learning approach:

When you get this elegant experiment box, please do not hurry power on the board, we suggest you:

1. Spend about 1 hour to read the manual carefully.
2. Get familiar with various modules built in this experimental box, especially the definition and intention of wire jumpers.
3. Pick up the example which suits your situation from the handbook to do experiments. If it could be run smoothly, please think about why this example is written like this. And then try to change some statements in the program, and then see the result on the board. By this way, you can have a deep impression how the software is driving hardware acting as you wish. We believe this is the best way to learn how to program an embedded system.

1.2 Each interface module definition:



XI2000 8051 Development board XUELIN electronics

items	Port	comment
1.communication and downloading	JP14	RS232/USB communication selector(select actual used port)
	JP13	RS232/USB communication selector(select actual used port)
	JP17	Programmer/simulator selector(pop on=program, press down=simulator)
	K16	Reset. When it is pressed, the program restarts.
	JP2	USB communication port, for communication, simulation, programming and power supply.
	JP1	RS232 communication port,exclusive with USB communication, anyway, when use RS232 communication, also need USB cable to supply power.
	JP23	ISP downloading head,support to download program from host PC to board. It needs basic understanding of the chip will be burned.
2. power supply	JP33	Power switch. It is only applicable for extra power supply. When using USB for power supply, it is invalid.
	J4	Extra power input.(Default with USB for power supply, no extra power input)
3. CPU simulation	IC16	Experimental socket. When programming, insert AT89S52 and simulating with SST89E564.(attention: make sure the chip breach is up.)
	JP44	P1 output port(P1.0~P1.7)
	JP53	P3 output port(P3.0~P3.7)
	JP51	P0 output port(P0.0~P0.7)
	JP52	P2 output port(P2.0~P2.7)
	JP59	40PIN simulator head, same order with standard 8051 pins, take care of pin order
4. Analog to Digit converter ADC0804	J3	ADC0804 control terminal
	JP35	ADC0804 data terminal
	JP30	External analog signal input.
	JP60	AD jumper. Default state is on, if needing external analog signal, input from AD input port JP30.
	ADJ13	AD experiment. Used for analog signal, adjustable 10K resistor.
5. Digit to analog converter DAC0832	JP24	DAC0832 control end, in this system, connect WR to P36, CS to P27
	JP27	DAC0832 data end, in this system, connect to P0 port
	J2	DAC0832 output end, connect to oscilloscope.
6. LCD display 12864LCD	JP41	LCD experiment jumper, when doing LCD experiment, make it closed
	Note: here we have 12864 LCD.	
7. 8bit digit led		

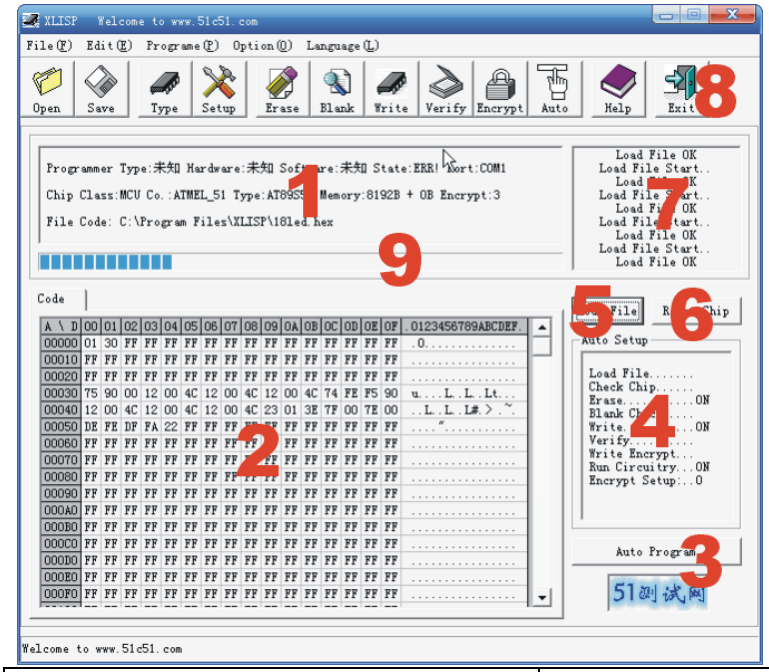
	JP8 JP5	control end, in this system, connect to P2 port. data end, in this system, connect to P0 port.
8. decoder(74LS47)	JP19	74LS47 data input.
	JP88	74LS47 data output, in examples, could connect to JP5
9. parallel in serial out74LS165	JP28	74LS165 data input.
	JP21	74LS165 data output.
10. 3-8 decoder74LS138	JP22	74LS138 data input.
	JP25	74LS138 data output
11 serial in parallel out74LS164	JP20	74LS164 data input, in examples, A/B is connected to P3.0, CLK to P3.1.
	JP26	74LS164 data output, in examples, connect JP32 to show 8 way output.
12 inverter(74LS14)	JP29	74LS14 data input
	JP34	74LS14 data output, change signal from low to high or high to low
13 step motor	JP31	Motor control signal input
	JP36	Motor output
14. 93C 46	JP46	93C 46 control
15 24C 02	JP38	24C 02 control, in examples, SLC is connected to P3.6, SDA to P3.7
16 speaker	JP16	Input signal for speaker, in examples , connected to P3.3
17 remote	JP45	Input signal for remote receiver, in examples, connected to P3.7
18 18B20	JP39	Output for temperature detector, in examples, connected to P3.0
20 8way indicator	JP32	Correspond to D00---D07 lights, 0=on, 1=off
21 matrix switches	JP50	Correspond to 4*4 matrix keys, in examples, connected to P1
22 1 way relay output	JP1	Correspond to JP00 relays,
23 DS1302	JP83	in examples, connected to P1.0,P1.1,P1.2
24 NE555	JP80	JP80 OUT W2Adjustment
25 PS2	JP81	TO PC PS2 KEYBOARD
26 Crystal select	JP89	S1 USER ----12MHZ
27 SD CARD	JP74	JP74 CS DI CK DO 5V GND
28 dig switch	JP40	Correspond to J00---J07 dig switches, on=0, off=suspending
29 232 PORT	JP1	TO PC RS 232
30 485 PORT	JP76	J24 A GND B J25 RO.DI .E
31 CAN BUS	JP75	Retention
32. 8155 extension		JP63 for control, JP58 for data, JP61 for PB port
33 Chinese lattice	JP55	Row scan for top half, in examples, connected to P0.
	JP54	Row scan for bottom half, in examples, connected to P2
	JP62	Column scan, connect to 74LS154.

Chapter II: Quick Start – follow me to make XL2000 Marquee experiment

2.1 software installation:

Insert CD shipped with the package, open the driver \XLISP directory. Double-click the setup.exe, follow the prompts and click next button until the installation is complete. If you get the remainder that system files are old, probably you need restart your computer and continue the installation.

First of all, let's use XL2000 over serial port to do a simple marquee experiment.



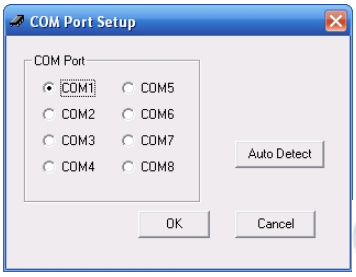
① software status information window Show information about the current programmer, status of current connection, serial port, chip and target object file.	② code and data zone: Show the code/data that is burned into chip, also you can edit the code/data directly here.
③ Intelligent all-steps-in-one button One of the features of this software, you can achieve fast programming. Please refer to the details of the relevant sections.	④ Intelligent button set up window Show the status of each step about the whole programming process, includes update file, checking chip, erase, write, verification, encryption, etc.
⑤ file update Manually updates the target file.	⑥ reset the target board Pressed the button to reset the target board. It is helpful for on-line debugging.
⑦ status report on the operation of window Dynamic display of all the current programming operation.	⑧ menu and toolbar Short cuts for some menu item.
⑨ progress indicator of the programming Dynamic display of the current operation progress.	

Hardware installation:

Open the package of XL2000, insert the serial line (9 for 9-pin), then plug the USB cable (for 5V power supply). Press down power switch, and power indicator light is on.

Make sure the following is set up correctly:

- Jumpper JP14/JP13 is switched to RS232 end, the other end is USB.
- programming/simulation button is in pop-up (programming) state.
- CPU is AT89S52 at the cpu socket, and the lock is fastened.

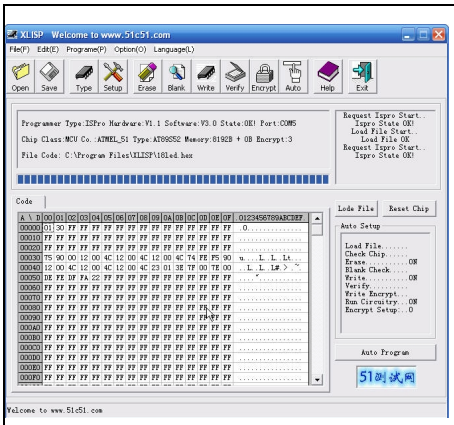


Attention

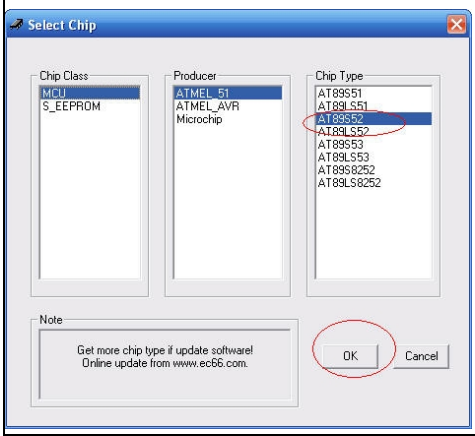
2.2 software

Here are the basic software operations: Double-click the XLISP icon on the desktop to start the program. At this moment, a serial port option box is popped up. **At** this point, if you are not sure which port you can use, please hit "auto detect" button. Or you can select the COM port as you decided. By default, you can select COM1 port.
(For USB communication, you may need to select COM3 or COM4, refer Chapter III for the specific USB installation guide) In case of XLISP software unintended termination, reopen the software: hit the menu options/serial /auto-detection, it is very convenient!)

1 At this point, if the serial port settings are correct, then there will be the main interface of the following: the status report on the operation of the window display --- programmer detecting is OK! If not OK, please check if the COM port settings are correct? Power indicator light is on? The simulation/programming mode is in programming (up) state? USB/232 jumper is switched to rs232 ?)	2 In order to simplify the steps, the software settings should be checked at the first time. First, click "Settings" button in the toolbar, In the automatic programming options: marked the "Erased", "write" "target board to run" and then click OK. In generally, detecting chip type, checking empty, verification and written encryption should not be marked, it is a waste of your valuable programming/learning time.



3 types of chips dialog box: select MCU\ATMEL_51\AT89S52, and then click OK.



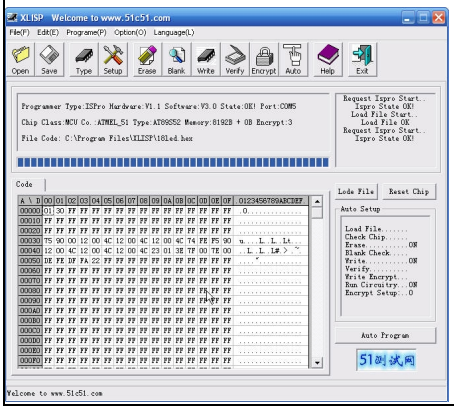
5 At this point, click "smart all-in-one" button, and you will see the progress bar of programming instructions, at the same time, in status report window, you can see status of each step:

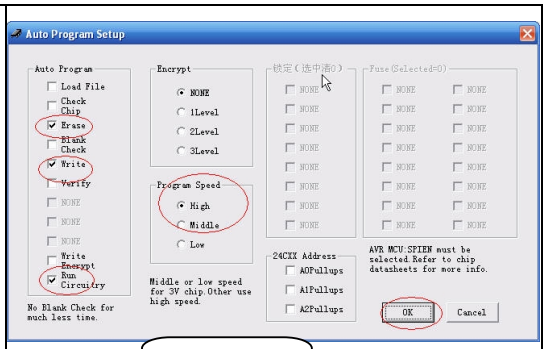
Erase staring ....Erase complete.

Programming starting ....

Programming is OK!

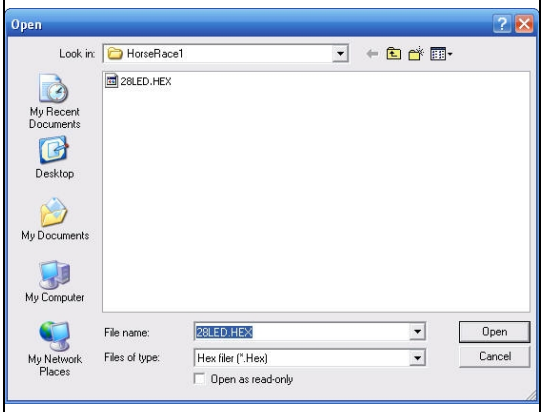
Program exiting, and target board is running!





Attention

4, the main interface: click the "Open", to find an exmaple in the CD. For example, test cases\...\28LED.HEX, and click OK.



Attention; In the process of programming operation, the LED indicator for programming is on, after completing programming, the LED will be off. This light, as the programming state indicator, is very important! At this point, programming procedures have been completed.

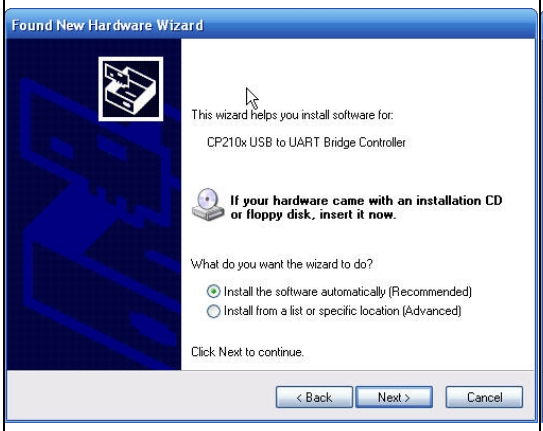
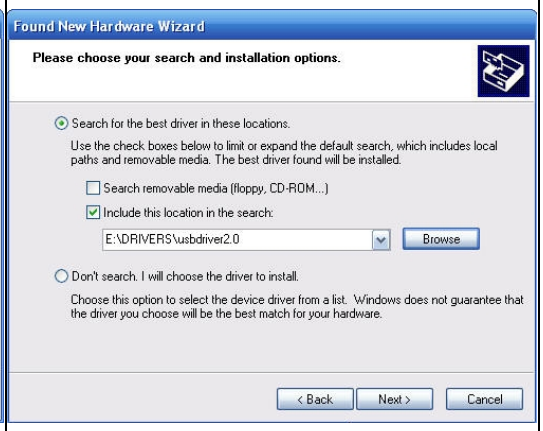
Next, the hardware needs to be connected: As this is a marquee case using P1 port of 89s51, pick one of 8PIN line, insert one end to the P1 port(JP44) of CPU on XL2000, the other end to the eight-way light indicators(JP32). We can see the P1 port 8 LED flashes one by one. This shows the program is running successfully. If it is not running, press the system reset switch (K16). Please refer to the related program readme for other test cases on how to do hardware connection!

Attention

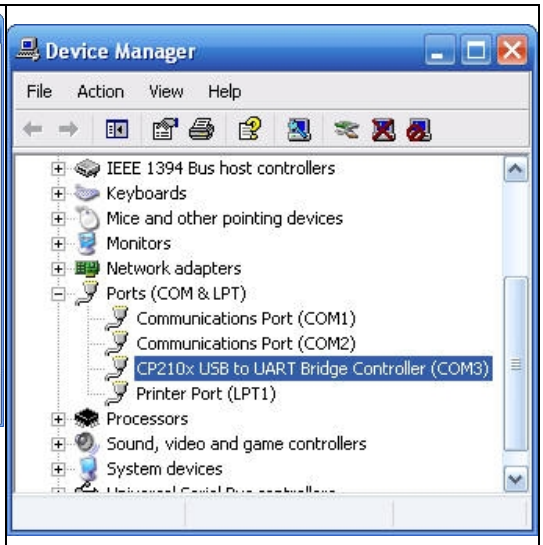
Chapter III of the USB interface Installation Guide

XL2000 provides a serial or USB communication for your options. In the above chapter, we introduced the use of serial communication experiment. If you use the USB communication, serial lines can be removed. At the same time, please pay attention to switch jumper JP13, JP14 to USB end.

Please follow below steps to install USB/serial driver

<table>
<tr>
<td>Step one: connect XL2000 to PC USB socket by the USB cable in the package: “Found New Hardware Wizard” is showed, select "from the list or specific location (Advanced)" option, Enter the next step;
 
</td>
<td>Step two: Select "in the search to include the location", click browsing to open CD and switch to the folder ..\drivers\XLISP drivers\USBDRIVER2.0\, Enter the next step
 
</td>
</tr>
<tr>
<td>Step three: Pop-up "to install hardware" dialog box, If prompts with "did not pass the Windows logo testing ...", it does not matter. Click "continue", Started to install wizard software; Then pop "Found New Hardware Wizard to complete" dialog box, Click Finish.</td>
<td>Step four: The second pop-up system "found new hardware wizard" dialog box, Repeat the above steps; Pop-up dialog box in the bottom right corner "of the new hardware is installed and can be used "USB drive has been successfully installed. You can enter the system:ControlPanel\system\hardware\Device Manager in the following port information, That the system has been installed in the right USB drive.</td>
</tr>
</table>

Found New Hardware Wizard
Completing the Found New Hardware Wizard
The wizard has finished installing the software for:
CP210x USB to UART Bridge Controller
Click Finish to close the wizard.
< Back
Finish
Cancel



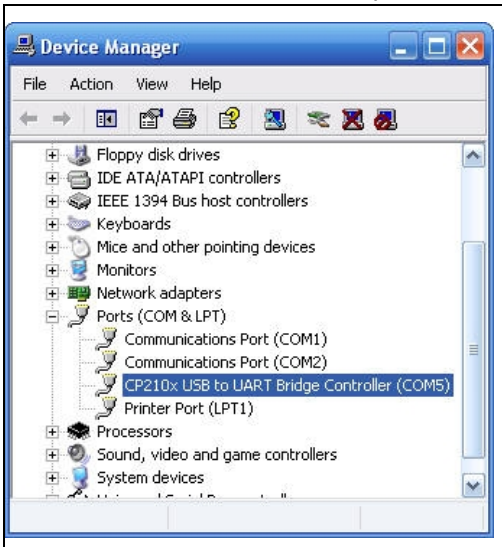
olution for Failure of installation:

If unintentionally terminate the installation of the software, you can delete the USB device with yellow exclamation mark and then repeat the above steps to install it again!

USB installation for special case:

Under normal circumstances, the installation of USB is as mentioned above. Under some special circumstances, your computer may have installed other usb printer, usb programmer, and so on. In this case, available COM port for USB device maybe COM5 or COM6. Anyway, KEIL software may only support simulation of COM1, COM2, COM3, COM4. How do we solve this?

Here's a better solution to this problem:



(Figure 1:When PC configured with many usb devices, the available COM port maybe COM5, which is not supported by simulation software, such as KEIL)

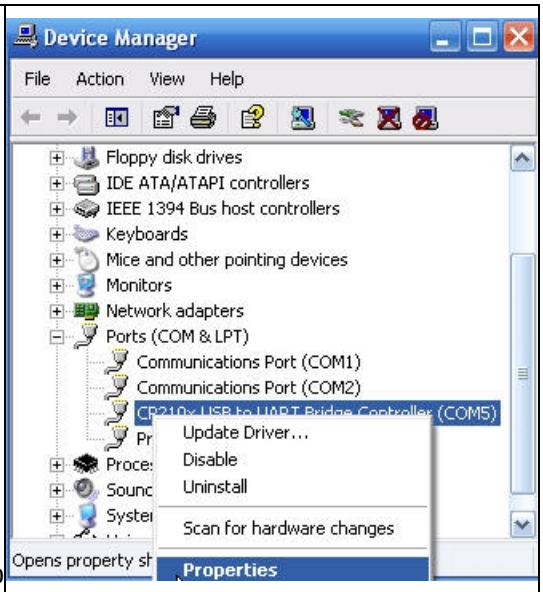


Figure 2: right button menu of the COM5 device, click properties menu item.

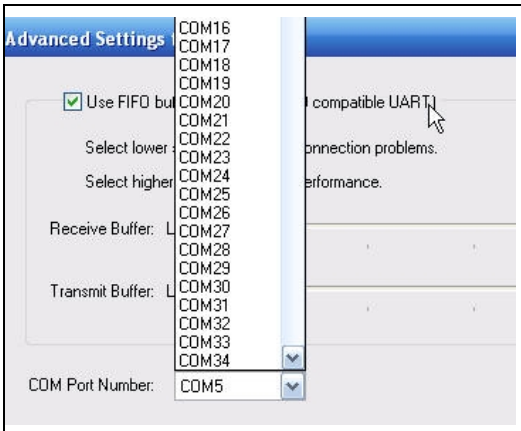


Figure 3: enter the usb serial port (com5) property, click the "port settings" and then "high-level properties". Choose a less often used COM port, for example, COM3.

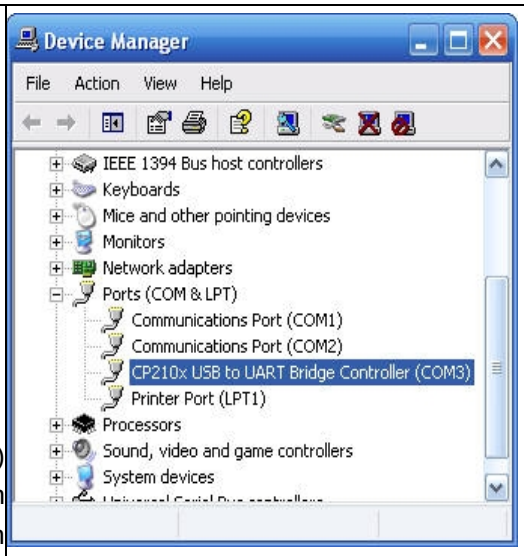
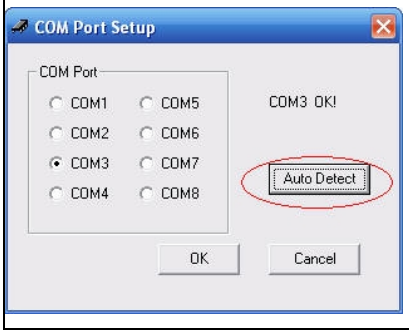


Figure 4: System has allocated COM3 for virtual usb serial port.

(tips for USB COM port can not find when running XLISP software)



After USB driver installation is complete: running XLISP.exe, and pop-up a COM selection dialog box, select one port and click auto detecting button until one is OK. Same scenario, when doing KEIL UV2 simulation or serial port communication experiment, we must choose the COM port.

Chapter 4 Using ISP downloading part

4.1 ISP to download part of the presentation

ISP (In-System Programming), means the device on the board can be programmed directly with end-user code/data, do not need to get the device off from the circuit board. ISP technology is the development trend for future. The ISP part of XL2000 is the leading product on the market with traditional programmer's reliability and ease-of-use download line. Through the single-chip timing control, RS232 serial communication solves the problems of parallel port ISP compatibility and reliability. By introducing the related pins of the ISP download head into the circuit board, we can program the board online with great speed and convenience.

ISP to download a list of some of the support of the chip:

51 Series single-chip:
AT89S51, AT89S52, AT89S53, AT89S8252, AT89LS51, AT89LS52, AT89LS53, AT89LS8252

AVR Microcontroller Series:
AT90S2323,AT90S2343
AT90S4433,AT90S8535
ATmega16,ATmega16L,ATmega161,ATmega161L,ATmega163,ATmega32,ATmega32L
ATmega323,ATmega323L,ATmega64,ATmega64L
ATmega8,ATmega8L,ATmega8515,ATmega8515L
ATmega8535,ATmega8535L
ATtiny12,ATtiny12L,ATtiny13,ATtiny13L
ATtiny15,ATtiny15L,ATtiny22,ATtiny22L,ATtiny26,ATtiny26L

PIC Microcontroller Series:
PIC16F870,PIC16F871,PIC16F872,PIC16F873,PIC16F874,PIC16F876,PIC16F877,
PIC16F873A,PIC16F874A,PIC16F876A,PIC16F877A

AT24CXX：
AT24C01,AT24C02,AT24C04,AT24C08,AT24C16,AT24C32,AT24C64,AT24C128,AT24C256,AT24C512

Advantages of ISP download head on XL2000:

1. If you design the product as an open or scalable system, then you need to use this download line or other download line to upgrade the single chip.
2. Upgrade software version before shipments. Many products may need to fix various bugs before the delivery to the customer. However, the IC may have been weld to the

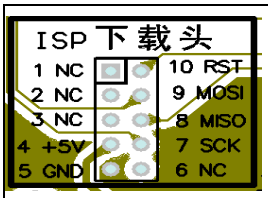
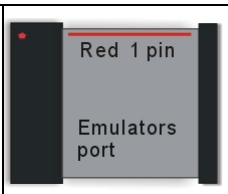
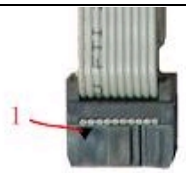
circuit board and can not be removed easily. You can use this download head on XL2000 to update the software online with great convenience.

Several ways to download with XL2000 ISP:

1. Reserve downloading sockets on the target circuit board, by this way, we can download the software in the chip online.
2. If you have not reserve any download socket for the download head, and want to use XL2000 ISP, in this case, you can make a download head yourself with bare lines and weld it to the target board.

4.2 Definition for XL2000 download head (Read below table carefully and make sure you totally understand it before using!)

1 NC(Vacant)	2 NC(Vacant)	3 NC(Vacant)	4 +5V	5 GND
6 NC (Vacant)	7 SCK/SCL	8 MISO/SEN/WP	9 MOSI/SDA	10 RST

		
The order direction of downloading head is same as other chips, anti clockwise direction.	The pin definition on the board is 1-1 mapping with downloading head.	The plug (1) there has a triangular symbols, make sure to avoid pick the wrong line.

Tips: if you are still not sure the order of pins, better have a check with multi-meter after connecting.

Special attention:

The pin 4/5 of the downloading head is already provided with +5 power supply, therefore, there is no need to configure a power for the target board. At the first use of the downloading head, please check if the power is not short-circuit on the board? As well as if the pins of ISP is connected correctly? You can refer following to connect the ISP downloading head:

http://www.51c51.com/bbs/dispbbs.asp?boardID=19&ID=28470&page=1

In addition, because of the use of the downloading functionality of S51 series of single ship part of software XLISP, make sure there is no chip in the socket of XL2000 when using the downloading head.

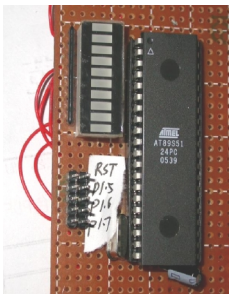
4.3 ISP pin connection method with typical chip

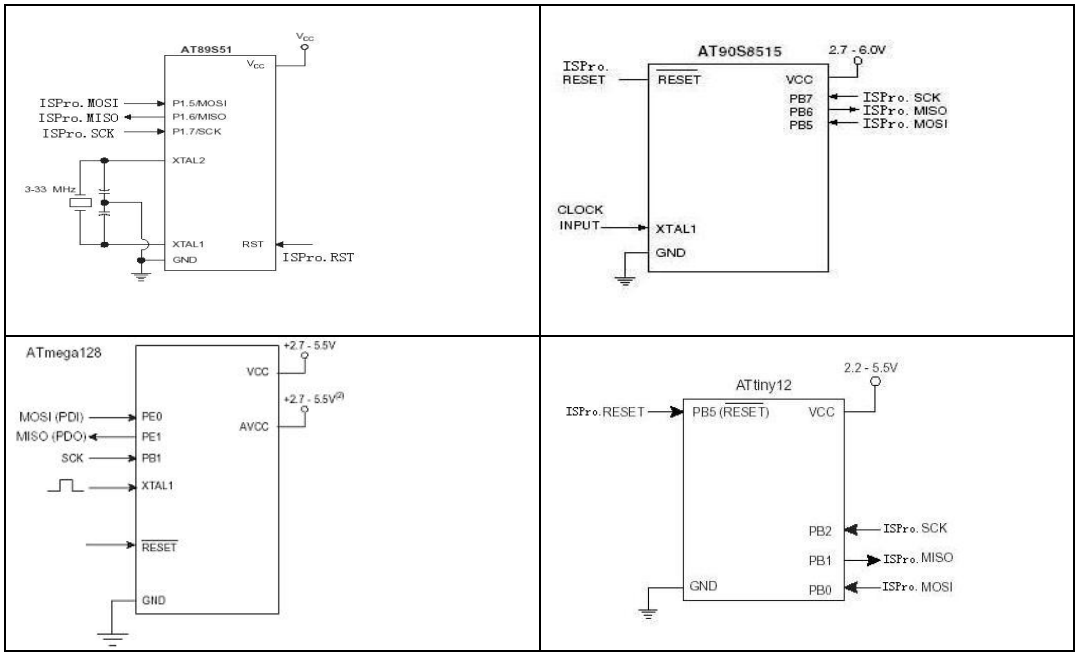
Here are some ISP pin connection methods with a typical chip.

Please refer to chapter two for the software operations.

AT89S Series, AVR family connection method **(refer to the self-made 89S51 target board)**

Download<----->Single-chip goal
RST <------->RST
MOSI <------->MOSI
MISO <------->MISO
SCK <------->SCK
VCC <------->VCC
GND <------->GND



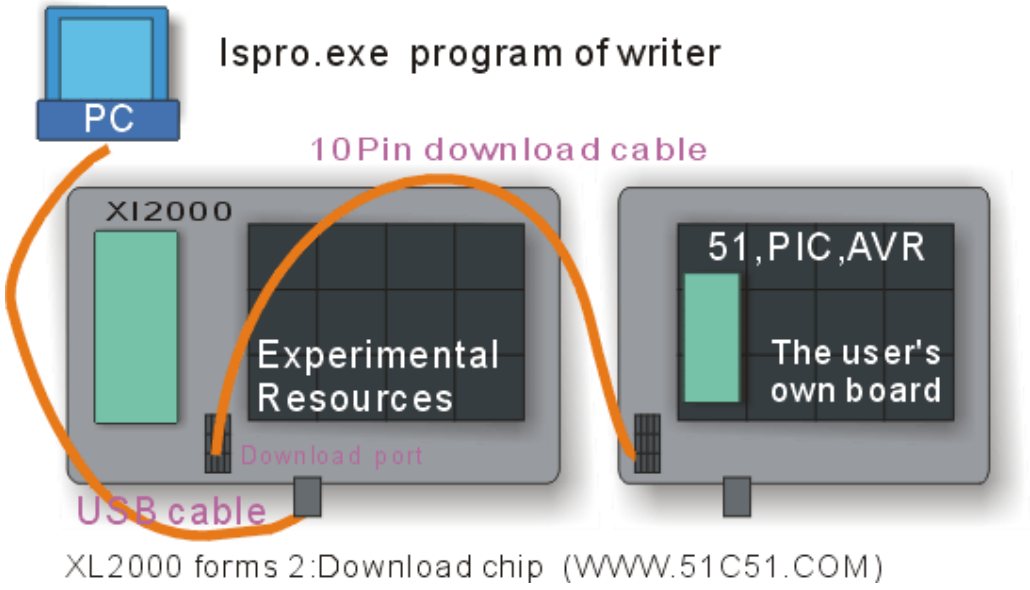


1. AT89S8252 has internal data EEPROM, can do on-line programming.
2.Requirement for a simplest target board system: Crystal (4MHz above), target MCU, 5V power supply (for the target board and programmer with downloading functionality).
3. Better make the functionality of ISP pins of target single-ship exclusively when designing the board, do not multiplex with other functionality.
4. If reset circuit is composed of RC circuit, then the RESET pin could be connected directly. Kindly reminder: the secure capacitance for MCU can not be too high. Recommend value maybe 1uF, better not exceed 10uF.
Connecting method for PIC series: refer chip manual for PB7, PB3, PB6 definitions, different PICs may be different.

PIC16F87X Pin Name / During Programming / Function / Pin Type RB3 / PGM / I RB6 / CLOCK / I RB7 / DATA / I/O MCLR / RST / P* VDD / VDD / P Vss / Vss / P	ISP downloading<----->target single-chip RST <------->Vpp(/MCLR) SDA <------->DATA(PB7) SEN <------->PGM(PB3) SCK <------->CLOCK(PB6) VCC <------->VCC GND <------->GND

AT24CXX series of ways to connect

AT24CXX 8-Pin PDIP NC 1 — 8 VCC NC 2 — 7 WP——ISPRO.WP NC 3 — 6 SCL—ISPRO.SCL GND 4 — 5 SDA—ISPRO.SDA	ISP download<----->AT24CXX RST <------->RST SDA <------->SDA WP <------->WP SCK <------->SCK VCC <------->VCC GND <------->GND



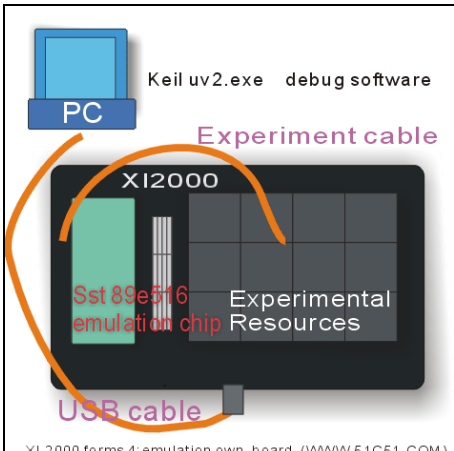
XL2000 forms 2:Download chip (WWW.51C51.COM)

Chapter V XL2000 simulation step guide

5.1 Overview: The simulation functionality of XL2000 is implemented by the simulation module. Through the cooperation with KEIL software, we can support both for on-board resources simulation, but also can support simulation of external target board resource by 40PIN ISP downloading head.

- Simulation can be 89C51, 89C52, 89S51, 89S52, 89C58 microcontroller with 51 core, and so on.
- Directly support KEIL C51 IDE simulation environment.
- USB/RS-232 communication interface, adaptive baud rate 4.8 Kbps-57.6 Kbps. Especially for laptop users without any RS-232 interface.
- Monitor program takes up few resources, if run at full speed, take up no resources.
- 63K program space inside the chip, can be updated online at any time.
- Support single-step, breakpoint, full-speed, variable reference, RAM variables, etc. debugging.
- Support assembly, C language and mixed source debugging.
- Simulation interface on board can be connected to any type of target board, so as to achieve unlimited hardware simulation of the expansion.

Hardware installation: first of all, connect the 9-pin serial port plug into the PC serial port, like COM1. Connect usb cable to PC as the power supply, Insert the simulation chip (not at89s51) into the socket on board and fasten the socket. Press down JP17 (programming / simulation button) and make the board work in simulation mode. (NOTE: here it is run with serial port, if by USB, then insert the USB line, at the same time make sure JP13, JP14(232/USB) is switched to USB end) If simulating on-board resources, first of all, connect the pin lines to the related IO hardware port according to the experimental objective. The simulation result will be shown directly on the XL2000 board.



XL2000 forms 4: emulation own board (WWW.51C51.COM)

If you need simulate a external target board, connect the simulation head into the target board, then the simulation result will be shown on the target board.

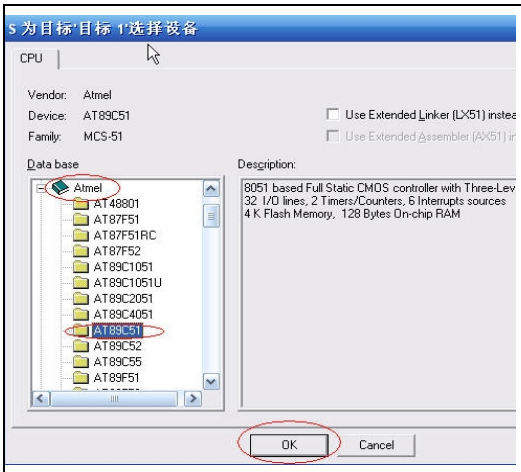
Please pay attention to the insertion direction!

Software installation: copy cdrom\Tools\keil\ to the root of the c disk, remove read-only attribute of all files.

(ATTENTION: must be under c root directory)

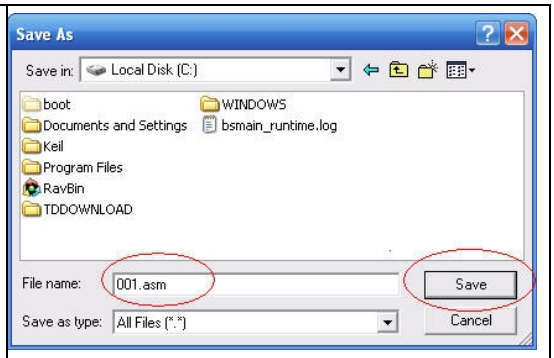
Execute keil\uv2\uv2.exe, you can create a shortcut for uv2.exe as you wish. (Uv2 icon)

5.2 Create your first project (software operation guide):



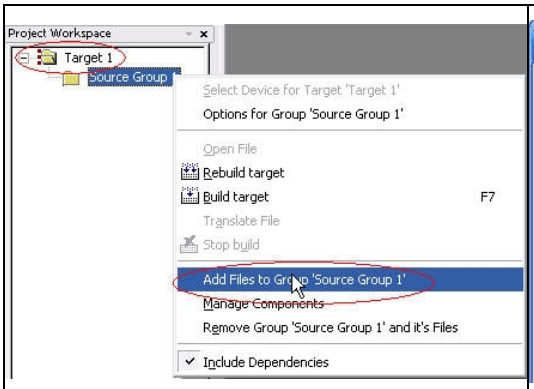
1 Click Project (the project) menu, Select New Project, In the "File Name" Enter your first name of the project, let us assume it as "test". "Save" the file with extension .uv2, this is the KEIL uVision2 project file extension. After that we can directly click the file to open the whole project.

Then pop-up a dialog box, it will let you choose single chip models, let's choose ATMEL --- AT89C51. Note that the actual use of the 89s52, they are totally compatible, do not have to bother.

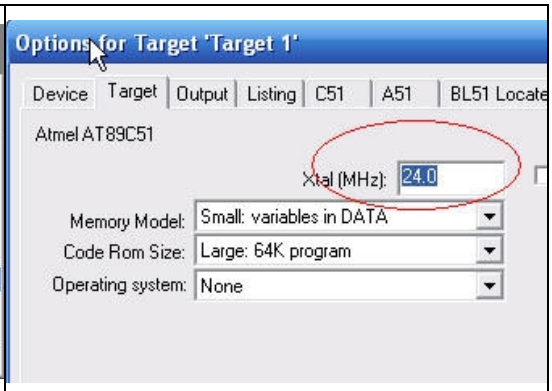


2 create assembly source file: Click FILE (file) menu, NEW ... (new file) to open a new text editor window, at the blank part, input one example program like marqueen LEDs. And then click FILE (file) menu of SAVE (Save) command to save the file, MUST save the file with suffix .**asm,** for example: c:/ 001.asm.

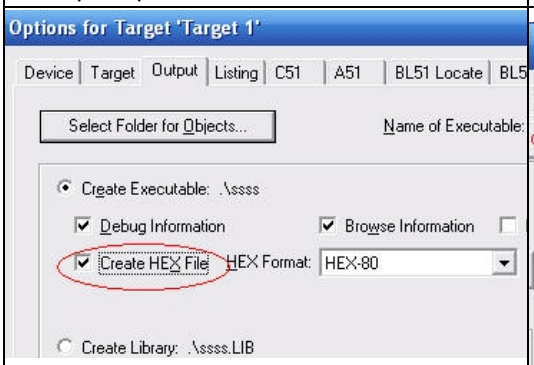
(Note that do not save the file under some directory with non-ascii characters. Better save the file under some standard DOS directory, at least 8 ascii char, no space in it.**)**



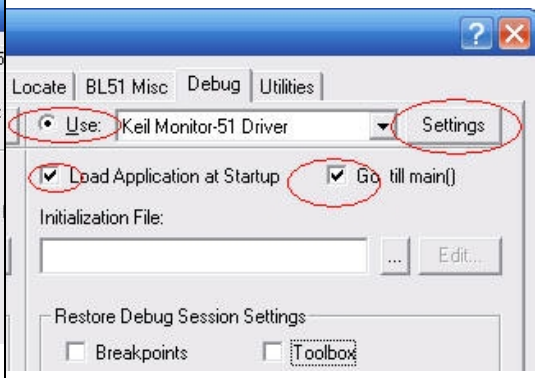
3. Click on "+" in front of the Target 1 menu, then Source Group 1(Source group 1), right-click to select "Add files Group Source Group 1" (source documents to be added into group 1) , at this moment, choose the type of file for Asm, select 001, then Add, in the prompt box, click "OK".


Options for Target 'Target 1'
Device Target Output Listing C51 A51 BL51 Locate
Atmel AT89C51
Xtal (MHz): 24.0
Memory Model: Small: variables in DATA
Code Rom Size: Large: 64K program
Operating system: None

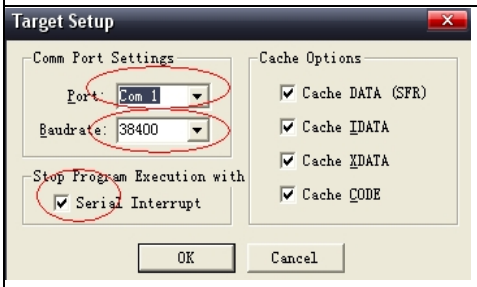
4. Simulation part is using Mon51 protocol, prior to use it, project must be set as follows: Click the "Project" (the project) menu, In the drop-down menu click "options for target 1, click "Target" (the target), enter the simulator frequency (12MHz).



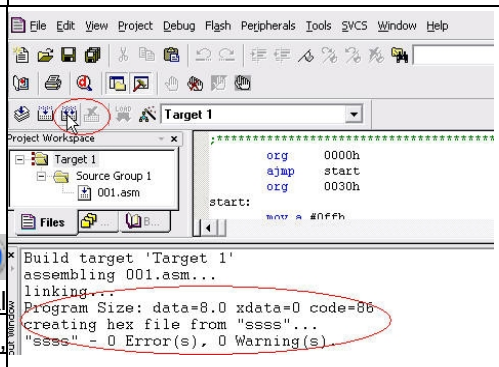
5. Select output (output) "Create HEX file" (generate a hex file) option, so that HEX file could be generated after assembling.



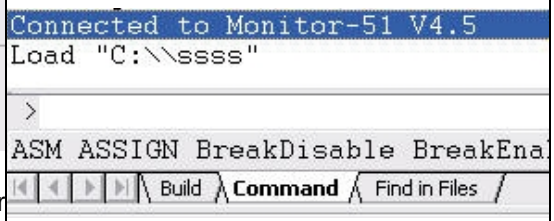
6. "Debug" (debug), click on "KeilMonitor-51 Driver", at the same time, select load the code to the emulator, run to main0, and then click Set



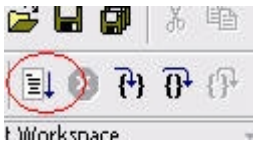
7 Click "Settings" to choose to use the serial port(must match with the actual situation, your computer may be COM2 or other). If you are not sure this, you can view Control



8. Press down below two small icons to

Panel \ hardware \port\communication port to solve it. At the same time, pay attention to not run other software may occupy the COM resources. Serial port debugging software must be closed, else may cause conflict. (If you are using a USB communication, then please select the virtual serial port number that allocated by the system.)	compile, (Or press F7). After the success of the compilation, you can see text like “0 error(s), 0 warning(s)…” as the red arrow shows. At this time, a hex file has been generated and we can burn it into a single chip with ISP downloading. Then we can do hardware simulation, connect simulation module into on-board socket and press down the RESET button on the board.
9, Press the third red d(debug) icon or ctrl+F5 to enter the simulation.	 At this point, the interface shows connection is successful! (Or there is some wrong with settings, please double-check) (Successful simulation screen.)

Click the "running at full speed" button as the red arrow points and connect experimental resources. This experiment connects the P1 (JP44) of the CPU to the eight-way indicator lights (JP32) by a 8PIN data cable. At this time you will see eight XL2000 red LED is flashing one by one, this means the success of the experiment.

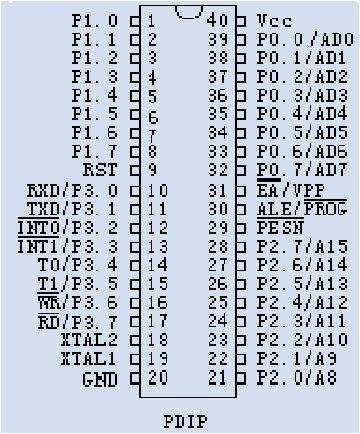


When exiting the simulation, press down the RESET button of XL2000, and then click d, the IDE will return to the editing mode. Press down the red d again, back to simulation mode.

Up to here, we have completed a standard KEIL software process. You can hit single-step running to watch the change of register and also change of the board. By this way, you can understand the process of the program running. **Note: when enter and exit simulation mode, please press down the RESET button of XL2000.**

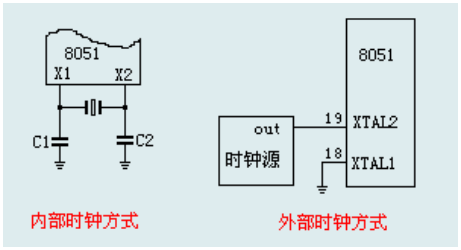
MCS-51 single-chip pin description

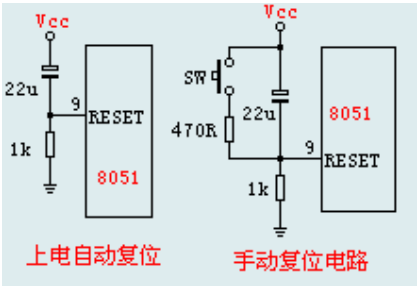
51 Series single-chips like 8031, 8051 and 89c51/89s51 are all adopting dual in-line package(DIP) with 40Pins. The following are specifications of the 40pins chart. Power and ground occupy two pins, external quartz oscillator clock occupy another two pins, total of 32(4*8bit) I/O ports occupy 32pins, the interrupt port multiplexed with P3 port. Next, let us explain the functions of each pin one by one:



PIN20: ground.
PIN40: +5 V power supply.
PIN19: XTAL1 clock, on-chip oscillation circuit input.
PIN18: XTAL2 clock, on-chip oscillation circuit output. 8051 can work in two clock mode, one is the on-chip clock oscillation mode, in this case, PIN18 and PIN19 need to be connected to an external quartz crystal (2-12MHz) and oscillation capacitor. The oscillation capacitor value takes 10p-30p. Another mode is the external clock, XTAL1 connected to ground, external clock signal connected to XTAL2.

Input and output (I / O) pins:
PIN39-PIN32: mapped to P0.0-P0.7 I/O port.
PIN1-PIN8: mapped to P1.0-P1.7 I/O port.
PIN21-PIN28: mapped to P2.0-P2.7 I/O port.
PIN10-PIN17: mapped to P3.0-P3.7 I/O port.





PIN9: RESET/Vpd reset signal. When power on 8051, clock circuit starts to work and a high TTL of 24 clock cycles signal occurs on RESET pin. By this way, the system is reset and initialized. The 8051 can be reset automatically and can also be manually, see below. In addition, RESET/Vpd is a multiplexed pin, during the Vcc power-down period, this pin can be connected to a back-up power and make the RAM data inside the chip not lost.

PIN30: ALE/PROG, when the CPU accesses external program, ALE (address latch) used to latch the output of low-bytes of the address. When CPU accesses internal memory, ALE will emit a pulse signal of 1/6 clock cycle. This signal can be used to identify whether the CPU works or not, and can also be used as an external clock output. When writing EPROM, RROG pin will be used as input programming pulse.

PIN29: when accessing external program memory, this pin generates negative pulse selection signal. PC's 16-bit data address will appear at the P0 and P2 port. External program memory will put instruction at port P0. It is read by the CPU and executated.

PIN31: EA/Vpp, internal and external memory selection pin. 8051 and 8751 single-chip has built-in 4KB code memory. When EA is high and instruction address is less than 4KB, CPU loads instruction from internal memory, if instruction address is greater than 4KB, CPU loads instruction from external code memory. However, when EA is low, CPU always loads instruction from external memory regardless of address value.

Icon explanation:

beginning of each chapter	Source program of experiment	Line connect of the experiment

Chapter VI of the single-chip experiment with examples

Limited by the space of this manual, here we provide several typical c51 application examples. To facilitate the novice to learn programming C51, we will show the source code, running photo, line connection method and principle schema for each examples. Of course, XL2000 is not limited by the examples presented here, thanks for the module design of this experimental instrument, user can configure the hardware modules with most flexibility and program against the configuration. By this way, user can have a comprehensive of C51 programming and designing.

For more asm and C sources, please refer to the examples in the CD shipped with the package, as well as the latest update at: www.8951.com!

Experiment 1: The simplest eight way marquee program

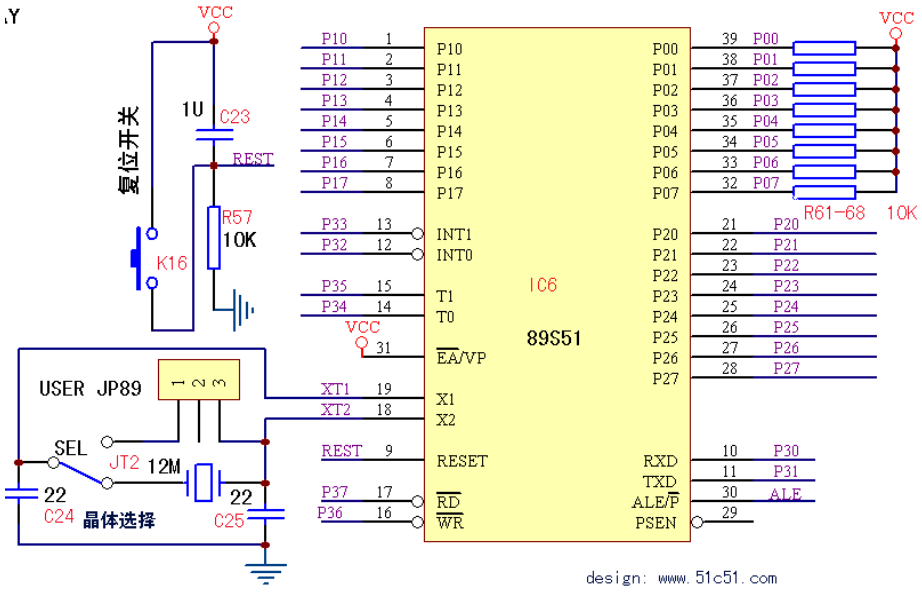
In this experiment, delay subroutines, clr, lcall, ajmp instrunctions will be used. Over these program elements, we can see eight lights flashing in turn through P1.0 to P1.7 port. User can learn from this example and have a initial grasp of the IO port programming.

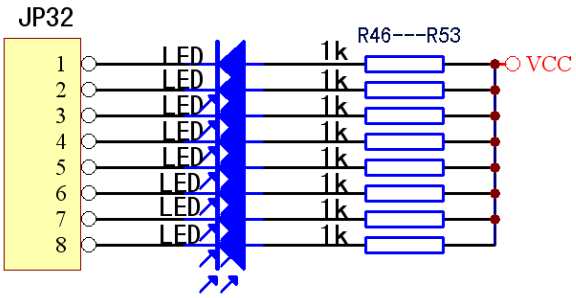
Practice 1: How to make the time of delay subroutine a bit shorter or longer?

Practice 2: How to use P0, P2 and P3 ports to implement the same control of 8-way lights?

Practice 3: how to implement different patterns in the light flashing?

Related schema:





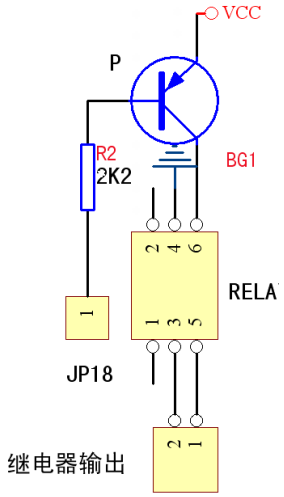
reference program：

```
org   0000h   ;start
ajmp LOOP; jump to LOOP label
org 0080h; get to 0030h to reserve some space
LOOP:
mov p1,#0ffh; turn off all lights
clr p1.0      ;turn on light at p1.0
lcall delay   ;delay for a while
clr p1.1     ;turn on light at p1.1
lcall delay
clr p1.2      ;
lcall delay
clr p1.3      ;
lcall delay
clr p1.4      ;
lcall delay
clr p1.5     ;
lcall delay
clr p1.6      ;
lcall delay
clr p1.7      ;
lcall delay
AJMP LOOP; jump to LOOP and restart to run
delay:      mov r5,#20 ; delay number。
d1:   mov r6,#40
d2:   mov r7,#248
      djnz r7,$
      djnz r6,d2
      djnz r5,d1
      ret
end
```

Connection methods: connect P1 port (JP44) of the CPU with eight-way lights(JP32) with one 8PIN cable. The connecting and program running photo like below: (8 lights turn on/off one by one).

Experiment 2: Control Relay

In the relay module, a PNP three tube 2N5401 is used to drive the 5V relay. The relay touch point is routed out by the JP00 terminal. When the relay does not act, the terminal is open. When the relay is active, the terminal is closed. Leading the touch point out could control external device, such as lanterns and so on. It should be noted that control current should not exceed 1A, the voltage should not exceed 120V. If using the touch point to control high voltage, be careful!



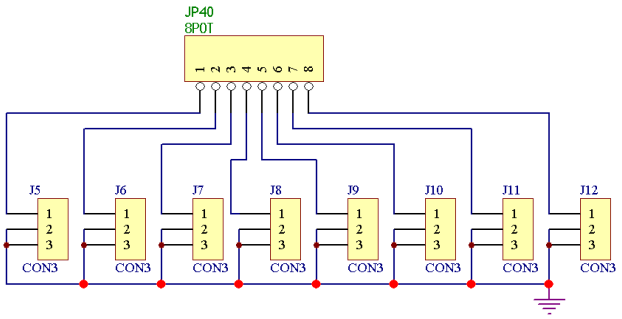
Input 8way marquee program above.

connect P1.0 of P1 port(JP44) of the CPU to JP18 of relay part, you can hear the sound of relay's open/close. Wired the terminal out, you can control the extern lanterns. The connect photo is like below:

XL2000 running photos

Experiment 3: 8-way lights showing the status of 8-way DIP switch

One end of 8-way DIP switch is connected to ground, and the other side could be wired out through JP40, the related schema graph is like below:



The purpose of the experiment: by setting different DIP switch status and let the 8-way lights indicates the status of 8-way DIP switches. By this way, you can understand the concept of bits and data transfer in the single chip.

Reference program:

```
org  0000h    ;Start
ajmp       loop
org 0080h          ;0030h to the Department of between 00-30 to avoid sensitive Address
loop: MOV A,P0; I P0 state (switch) read A
MOV P1,A       ;A data sent to the port P1 (light)
JMP LOOP       ;A fresh start
END
```

Eight-way DIP switches to JP40 with a 8PIN data cable into the CPU of the P0 I JP51,8PIN and then use a data cable to the CPU part of the P1 I (JP44) connected to the eight-way part of the light JP32.

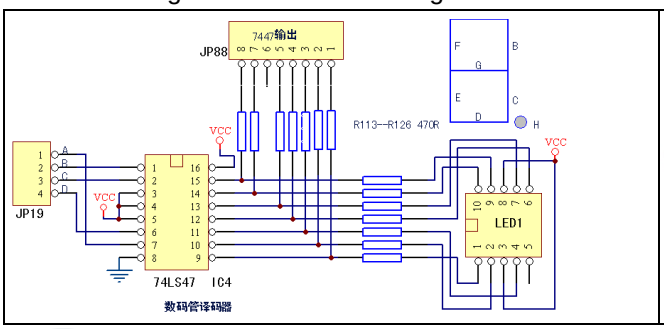
The result: Data photo map, corresponding to the switch to open, corresponding to the bright lights.

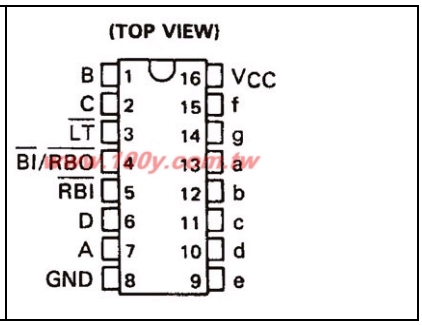
XL2000 running photos

Experiment 4: static scanning of the digital tubes

74LS47 chip is a driver chip of 7-segment tube, the number could be converted to the numbers that directly displayed in LED tubes through it. Therefore, the program could be simplified and also the IO resources could be reduced. However, from the cost saving point of view, such kind of chips have less used in the market. In most cases, dynamically scanning tube is used to implement digit number display. From students' perspective, it is necessary to understand this type of IC application.

The following is the connection diagram for 74LS47:





Connection method: connect the decoding part of the digital tubes (JP19) to P1 port(JP44), that is P1.0/P1.1/P1.2/P1.3 etc.

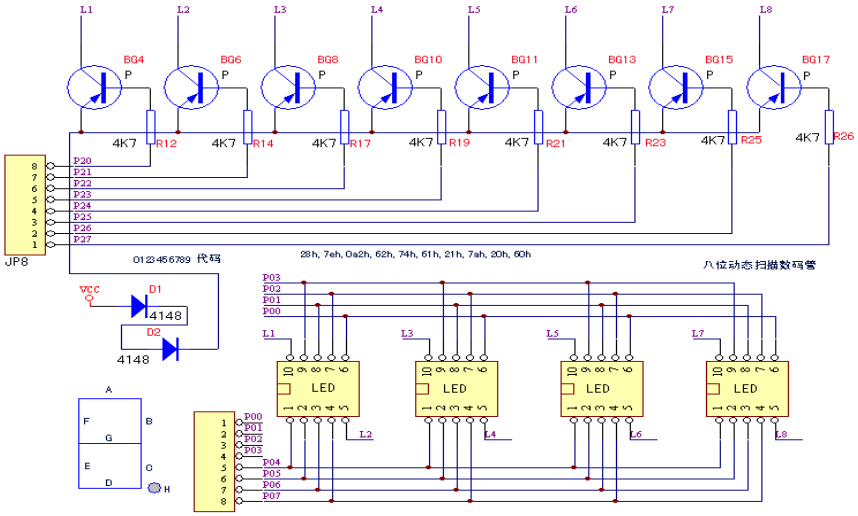
XL2000 running photos

Program: this program is sending number 0,1,2,3 to P1 port in turn and digital tube is showing these numbers accordingly.

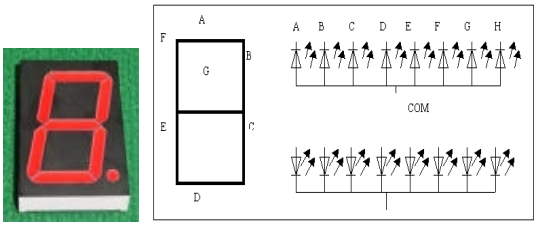
```
org   0000h   ; start
ajmp loop     ; jump to 0030h
org 0080h   ;
LOOP:
MOV P1,#1   ; set 1 to p1 port
CALL DELAY   ;delay
MOV P1,#2      ;set 2 to p1 port
CALL DELAY      ;delay
MOV P1,#3
CALL DELAY
MOV P1,#4
CALL DELAY
JMP LOOP          ;restart
DELAY: MOV R5,#50 ;delay subprogram
D1: MOV R6,#40
D2:MOV R7,#248
DJNZ R7,$
DJNZ R6,D2
DJNZ R5,D1
RET
END
```

Experiment 5: Digital tubes display 01234567 dynamically

Schema graph: data cables of 8 lights are bundled into JP5, the bit control is driven by 8 PNP triode and wired out from JP8.



How the digital tubes display numbers like 1,2,3,4? The digital tubes in fact consist of 7 segment tubes with shape '8' plus a decimal point. We names them as A, B, C, D, E, F, G, H.



After understanding the display principle, if we want to show a figure '2', turn on the A, B, G, E,D tubes will do. From the hardware connection, we can program as follow: (we have several 7-segment tubes, let us assume last one P2.7)

```
LOOP:
CLR P2.7     ;Finally, select the digital control
SETB P0.7    ;Section B does not shine
SETB P0.5    ;Decimal point does not shine
SETB P0.1    ;C-section do not
CLR P0.2     ;Other all
CLR P0.3
CLR P0.4
CLR P0.6
```

```
CLR P0.0
JMP LOOP    ;Jump to re-start
END
```

After compiling and burning this program into single-chip, we can see the figure ‘2’ is displayed on the digital tubes. Maybe you feel it is too cumbersome to write a so long program and display only a figure ‘2’. As we can see from above, showing figure ‘2’ is equal to trun off tube C, F and H. Due to the common-anode connection, that means 0(low TTL) is on and 1 is off. From the most bit to least, P0.7~P0.0 could be wrote as 01111110, the hex number is A2H. We can compute this hex number before programming and store these data into a table. After this, we can call it to display the figure easily.

Show	p0.7 /C	p0.6/E	p0.5/H	p0.4/D	p0.3/G	p0.2/A	p0.1/F	p0.0/B	HEXCode
0	0	0	1	0	1	0	0	0	28H
1	0	1	1	1	1	1	1	0	7EH
2	1	0	1	0	0	0	1	0	A2H
3	0	1	1	0	0	0	1	0	62H
4	0	1	1	1	0	1	0	0	74H
5	0	1	1	0	0	0	0	1	61H
6	0	0	1	0	0	0	0	1	21H
7	0	1	1	1	1	0	1	0	7AH
8	0	0	1	0	0	0	0	0	20H
9	0	1	1	0	0	0	0	0	60H

With this table, the displaying of figure ‘2’ could be simplified to:

```
LOOP:
CLR P2.7          ; select the digital tube on the left side
MOV P0,#0A2H    ; send the hex number of 2 to P0 port
JMP LOOP          ; Jump and restart
END
```

(running photos)

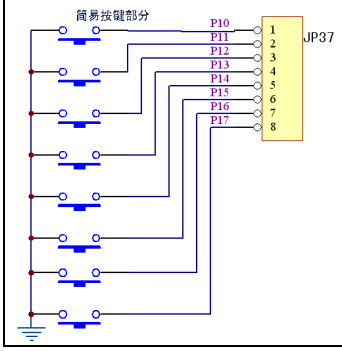
1. connect data port(JP5) of digital tube to P0 port(JP51) of CPU.
2. connect display port(JP8) of digital tube to P2 port(JP52) of CPU.

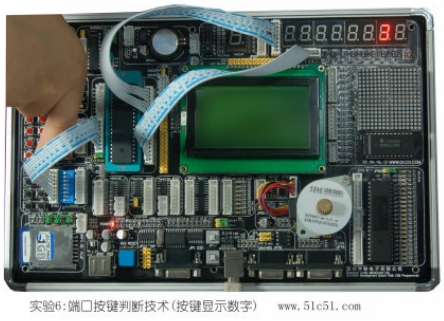
```
ORG0000H
      AJMP     MAIN
      ORG      0080H
MAIN:
      CLR      P2.0          ; select 1st digital tube
      MOV      P0,#28H              ; display '0'
      LCALL    DELAY                ; call delay
      MOV      P0,#0FFH              ; turn off '0'
      SETB      P2.0
      CLR      P2.1          ; select 2nd digital tube
      MOV      P0,#7EH       ; display '1'
      LCALL    DELAY
      MOV      P0,#0FFH
      SETB     P2.1
      CLR      P2.2          ; select 3rd digital tube
      MOV      P0,#0A2H             ;display '3'
      LCALL    DELAY
      MOV      P0,#0FFH
      SETB     P2.2
      CLR      P2.3               ;
      MOV      P0,#62H              ; display '3'
      LCALL    DELAY
      MOV      P0,#0FFH
      SETB     P2.3
      CLR      P2.4               ;
      MOV      P0,#74H                ;
      LCALL    DELAY
      MOV      P0,#0FFH
      SETB     P2.4
      CLR  P2.5                 ;
      MOV      P0,#61H
      LCALL    DELAY
      MOV      P0,#0FFH
      SETB      P2.5
      CLR      P2.6               ;
      MOV      P0,#21H                ;
      LCALL    DELAY
      MOV      P0,#0FFH
      SETB     P2.6
      CLR      P2.7               ;
      MOV      P0,#7AH                ;
      LCALL    DELAY
      SETB     P2.7
      MOV      P0,#0FFH
      AJMP     MAIN                   ;restart
DELAY:                          ;delay subroutine
      MOVR7,#2
    D1:  MOVR6,#25
    D2:  DJNZ      R6,D2
      DJNZ       R7,D1
      RET
      END
```

Experiment 6: port button press detecting technologies (display button)

This part consist of 8 touch keys, one end to the ground, the other end is wired out from JP48. When press the key, the corresponding port is low TTL.

Key port schematic





Connection methods:

1. connect JP48 to P3 port(JP53) of CPU by a 8pin cable.
2. connect data port(JP5) of the digital tube to P0 port(JP51) of the CPU.
3. connect display port(JP8) of the digital tube to P2 port(JP52) of the CPU.

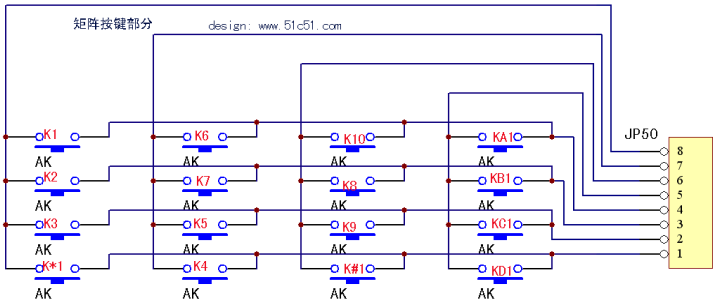
Task: display 0,1,2,3 by pressing K02, K03, K04, K05 keys.

```
        org 0000h;（1）
        ljmp start;（2）
        org 0080h;（3）
start:      mov  p2,#0ffh;（4）
        CLR  P2.6  ;select most right digital tube;（5）
         mov        p3,#0ffh   ;initialize P3 port（6）
l1:     jnb   p3.2,l2             ;（7）
        jnb   p3.3,l3             ; ;（8）
        jnb   p3.4,l4             ; ;（9）
        jnb   p3.5,l5     ; check key pressing（10）
        ljmp l1           ; checking in loop（11）
l2:     mov p0,#28H   ;display '0';（12）
        ljmp l1;（13）
l3:     mov p0,#7EH   ;display '1';（14）
        ljmp l1;（15）
l4:     mov p0,#0A2H ;display '2';（16）
        ljmp l1;（17）
l5:     mov p0,#62H   ;display '3';（18）
        ljmp l1;（19）
        end;（20）
```

Experiment 7: Matrix key recognition technology

Matrix key part consists of 4*4(16) keys and it is connected to JP50 port. The I/O port connected by row lines are outputs, and the I/O port connected by column lines are inputs. When no key is pressed down, all the outputs are high TTL. Once a key is pressed down, the input line is low TTL, we can read the corresponding port to know if any key is pressed down.

The following gives a specific example:



The purpose of the experiment: show 0,1,2…A,B,C,D,E,F on digital tube when corresponding key is down.

Connection methods:

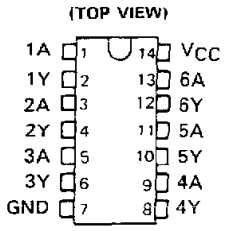
1. connect matrix key JP50 to P1 port(JP44) of the CPU.
2. connect data port(JP5) of digital tube to P0 port(JP51) of the CPU.
3. connect display port(JP8) of digital tube to P2 port(JP52) of the CPU.

Reference:

```
org   0000h
ajmp main
org 0080h
main:
      mov  dptr,#tab ;put tab at DPTR
      lcall  key    ;call matrix key detecting
program
      movc       a,@a+dptr    ;load tab data to
ACC
      mov  p0,a          ;move ACC to PO port
      CLR P2.1           ;open display on P2
      ljmp  main         ;display in a loop
KEY: LCALL KS            ;call key detecting
      JNZ K1             ;if key is down, continue
      LCALL DELAY2       ;no key down, call
L3:   JB P1.3,NEXT     ;
      MOV A,#0cH           ;
LK:   ADD A,R4         ;
      PUSH ACC             ;
K4:   LCALL DELAY2           ;
      LCALL KS             ;
      JNZ K4
      POP ACC
      RET
NEXT:
      INC    R4              ;add 1 to column value
      MOV A,R2               ;
      JNB ACC.7,KEY    ;
      RL A      ;
      MOV R2,A         ;
```

```
delay to remove shaking
        AJMP KEY ;get back to continue detecting
K1:     LCALL DELAY2
        LCALL DELAY2        ; call delay to remove
shaking
        LCALL KS            ;call key detecting
        JNZ K2              ;
        AJMP KEY            ;
K2:   MOV R2,#0EFH    ;store key value to R2
        MOV R4,#00H     ;move 1st column to R4
        K3:  MOV P1,R2    ; move R2 to P1 port
L6:   JB P1.0,L1        ;
        MOV A,#00H      ;
        AJMP LK         ;
L1:   JB P1.1,L2        ;
        MOV A,#04H     ;
        AJMP LK    ;
L2: JB P1.2,L3          ;
        MOV A,#08H      ;send 3rd row value to
ACC
        AJMP LK         ;
        AJMP K3         ;
KS:  MOV P1,#0FH     ;
        MOV A,P1        ;
        XRL A,#0FH      ;
        RET             ;
DELAY2:             ;
         MOV R5,#08H
L7:   MOV R6,#0FAH
L8:   DJNZ R6,L8
        DJNZ R5,L7
        RET
tab:
      db 28h,34h,28h,34h,0a9h,60h,20h,7ah,
      20h,21h,61h,74h,30h,62h,0a2h,7eh
end
```

Experiment 8: 74LS14 reverser



74LS14 is a 6way reverser, the definition of pins as left figure: A for input, Y for output, that is,
pin 1,3,5,9,11,13 for inputs, pin 2,4,6,8,10,12 for outputs.
In this instrument, two 74LS14 chips are used to consist of a 8-way reverser.

Experiment: 8-way adder, through reverser to see changes on LED outputs.

```
        org   0000h
        ajmp main
        org 0080h
main:       mov  a,#0
loop:       mov p1,a  ; P1 port output
        call delay  ; keep on for a while
         inc   a      ; show next figure
        jmp loop
delay:      mov r5,#50      ;call delay
d1:   mov r6,#40
d2:   mov r7,#248
        djnz r7,$
        djnz r6,d2
        djnz r5,d1
        ret
end
```

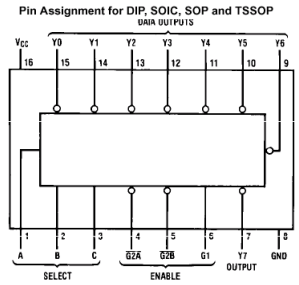
Connection methods:

1: direct connection: connect 8way indicators(JP32) to P1 port(JP44) of CPU by a 8pin cable. At this point, we can see the lights are turned off as binary sequence.	2: reverser connection, connect P1 port(JP44) of CPU to the inputs(JP29) of the reverser by a 8pin cable. Connect reverser outputs(JP34) to 8-way indicators(JP32). At this point, we can see the lights are turned on as binary sequence.

Experiment 9: 74 LS138 part of the 38 decoder part of the experiment

The 3-8 decoder is used to control 8 lines through 3 lines. In the circuit, it plays a role of extending IO resources.

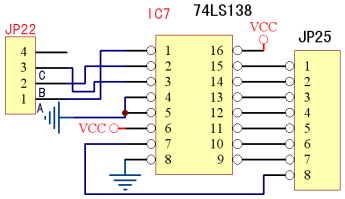
74LS138 Pin definition


Pin Assignment for DIP, SOIC, SOP and TSSOP
DATA OUTPUTS
Vcc Y0 Y1 Y2 Y3 Y4 Y5 Y6
16 15 14 13 12 11 10 9
1 2 3 4 5 6 7 8
A B C G2A G2B G1 Y7 GND
SELECT
ENABLE
OUTPUT

74LS138 Logic table

Inputs					Outputs							
Enable		Select										
G1	$\overline{G2}$ (Note 1)	C	B	A	Y0	Y1	Y2	Y3	Y4	Y5	Y6	Y7
X	H	X	X	X	H	H	H	H	H	H	H	H
L	X	X	X	X	H	H	H	H	H	H	H	H
H	L	L	L	L	L	H	H	H	H	H	H	H
H	L	L	L	H	H	L	H	H	H	H	H	H
H	L	L	H	L	H	H	L	H	H	H	H	H
H	L	L	H	H	H	H	H	L	H	H	H	H
H	L	H	L	L	H	H	H	H	L	H	H	H
H	L	H	L	H	H	H	H	H	H	L	H	H
H	L	H	H	L	H	H	H	H	H	H	L	H
H	L	H	H	H	H	H	H	H	H	H	H	L

74138The circuit schematic



Following experiment is a 8-way marqueen program through 74LS138, the 3 way inputs are P1.0, P1.1 and P1.2.

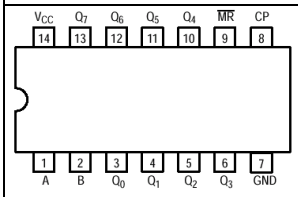
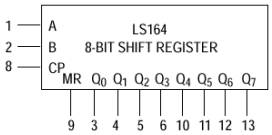
Connection method:

1. connect inputs(JP22) of 74LS138 to P1.0~P1.3(JP44) of CPU by a 4pin cable.
2. connect outputs(JP25) of 74LS138 to 8-way indicators(JP32).

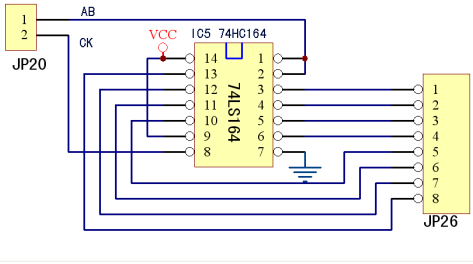
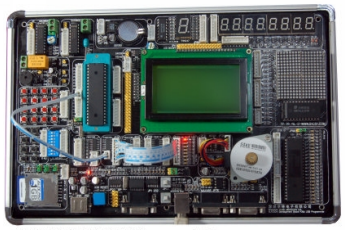
```
org 0000h
  ajmp main
  org 0080h;
AA EQU P1.0
BB EQU P1.1
CC EQU P1.2
MAIN:
CLR CC        ;
CLR BB
CLR AA
CALL DELAY ;
CLR CC        ;
CLR BB
SETB AA
CALL DELAY    ;
CLR CC        ;
SETB BB
CLR AA
CALL DELAY
CLR CC
SETB BB
SETB AA
CALL DELAY
SETB CC
CLR BB
CLR AA
CALL DELAY
SETB CC
CLR BB
SETB AA
CALL DELAY
SETB CC
SETB BB
CLR AA
CALL DELAY
SETB CC
SETB BB
SETB AA
CALL DELAY
JMP MAIN    ;
DELAY:
MOV    R5,#255
D3:MOV R2,#255
D4: DJNZ R2,D4
DJNZ R5,D3
RET
END
```

Experiment 10: 74LS164 serial in parallel out

In a single-chip system, if the parallel I/O port resources is not enough, and the serial port is free and not occupied, then we can use a 74LS164 to extend parallel IO port. 74LS164 is a shift register of serial in parallel out and equipped with clear terminal. Among the pins, Q0-Q7 are parallel outputs. A, B are serial inputs. MR is for clearing, 0 for clear output. CP is clock input.

74LS164 Pin definition	74LS164 Logic table
	

74LS164 Circuit

Connection methods:

1. connect P3.0/P3.1(JP53) of CPU to inputs(JP20) of 74LS164 with a 2pin cable.
2. connect outputs(JP26) of 74LS164 to 8-way indicators(JP32) with a 8pin cable.

The following program: 8 way marqueen through 74LS164.

```
org 00h
jmp start
org 0080h
mov scon,#00000000b     ;set UART to MODE0
start:
mov dptr,#table ;set data pointer to the TABLE
loop:clr a        ;clear ACC
movc a,@a+dptr           ;get data from TABLE
cjne a,#03,a1          ;
jmp start                ;
a1: cpl a                ;reverse the data
mov 30h,a                ;store ACC at 30H
mov sbuf,30h             ;
loop1:jbc ti,loop2 ;
jmp loop1                ;
loop2: call delay      ;
inc dptr                 ;
jmp loop
```

```
DELAY: ;
MOV   R5,#255
D3:MOV R2,#255
D4: DJNZ R2,D4
DJNZ R5,D3
RET
table : db 01h,02h,04h,08h    ;left shift
db 10h, 20h,40h,80h
 db 01h,02h,04h,08h
db 10h, 20h,40h,80h
 db 80h,40h,20h,10h        ;right shift
db 08h, 04h,02h,01h
 db 80h,40h,20h,10h
db 08h, 04h,02h,01h
db 00h,0ffh,00h,0ffh          ;
db 03h
END
```

Experiment 11: 74LS165 parallel in serial out

74L165 is a shift register with parallel input serial output. The serial port internal 80C51 works under mode 0. The parallel I/O port could be extended by shift register chip.

The definition of pins:

A, B, C, D, E, F, G, H: parallel input.

QH: serial output.

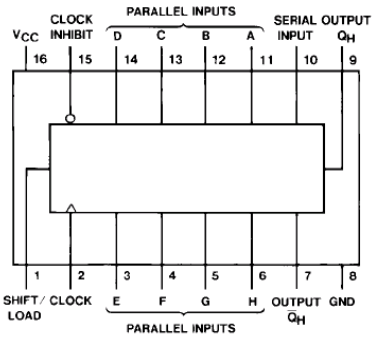
CLOCK: clock input.

CLOCK INHIBIT: clock disable. High TTL is valid.

SHIFT / LOAD: shift and set control

SER: expand multiple 74LS165 connected by head/tails.

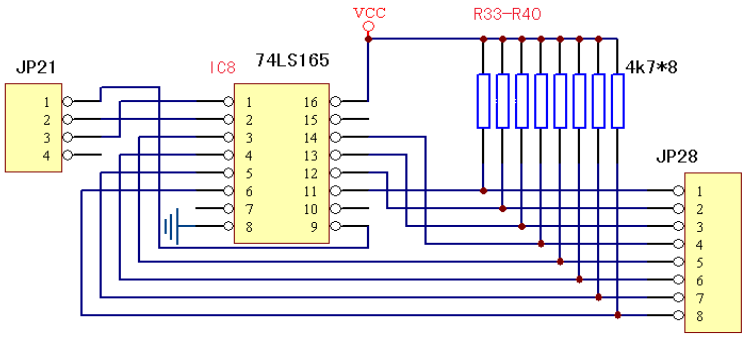
74LS165 pin definition



74LS165 logic table

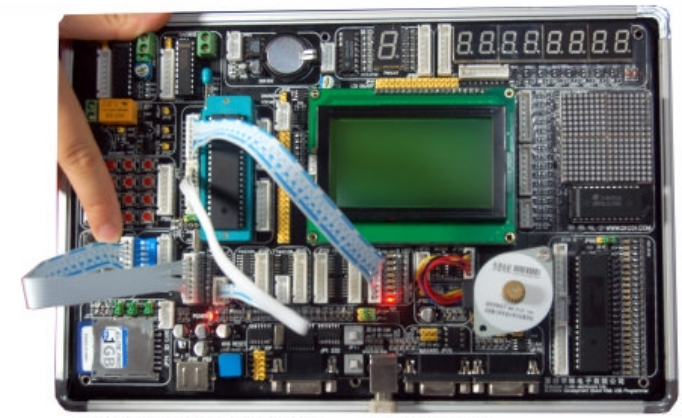
Inputs					Internal Outputs		Output
Shift/ Load	Clock Inhibit	Clock	Serial	Parallel A...H	Q_A	Q_B	Q_H
L	X	X	X	a...h	a	b	h
H	L	L	X	X	Q_{A0}	Q_{B0}	Q_{H0}
H	L	↑	H	X	H	Q_{An}	Q_{Gn}
H	L	↑	L	X	L	Q_{An}	Q_{Gn}
H	H	X	X	X	Q_{A0}	Q_{B0}	Q_{H0}

74LS165 circuit:



Connection methods:

1. connect P3.0~P3.3(JP53) to inputs(JP21) of 74LS165 with a 4pin cable.
2. connect outputs(JP28) of 74LS165 to 8way button switches(JP48) with a 8pin cable.
3. connect P1 port(JP44) of CPU to 8way indicators(JP32).
   Press down k00~k07, we can see d00~d07 are under control.



XL2000 running photos

reference program:

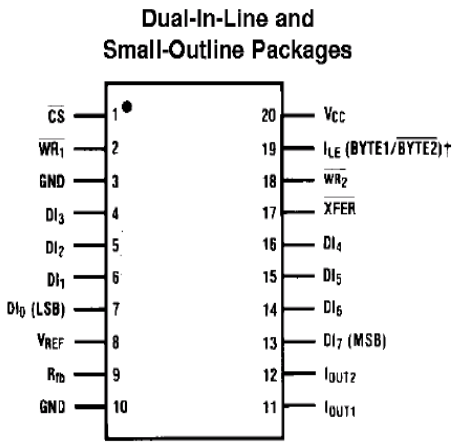
```
org 0080h
 loop : mov scon,#00010000b ; set MODE=0
    clr p3.2                    ; P3.2=0 to load data
    call delay1            ;
    setb p3.2                   ;P3.2=1 to output
    clr ri                      ;RI=0
 loop1:jbc ri,loop2        ;
    jmp loop1               ;
    loop2:mov a,sbuf        ;
    mov p1,a                ; output P1
    jmp loop                ; restart
```

```
delay:      mov  r7,#00h
tt:     mov  r6,#00h
        djnz  r6,$
        djnz  r7,tt
        ret
 delay1:
      mov r7,#02
      djnz r7,$
      ret
    end
```

Experiment 12: DA conversion and application of the principle of dac0832

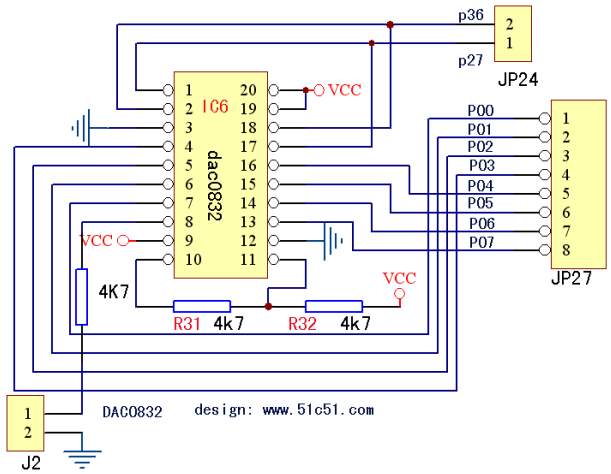
DAC0832 is D/A converter chip with 8-bit resolution, fully compatible with the processor, and it has the advantage of low cost, simple interface and easy conversion control. It is widely used in single-chip system application.

(1) the pin and functionality of DAC0832



DI0~DI7：data input line, TLL level.
ILE：latch data lines to allow input control signals, HIGH is valid.
CS：selection input line, LOW is valid.
WR1：write selection input signal of input register
XFER：input control line of data transmission, LOW is valid.
WR2：write selection for DAC register.
Iout1: current output line, when all inputs are all '1', Iout1 is largest.
Iout2: current output lines, the sum of its value and Iout1 is a constant.
Rfb: input signal feedback, there is an internal feedback resistor in the chip.
Vcc: power input (+5 v ~ +15 v)
Vref: baseline voltage input (-10v ~ +10 v)
AGND: analog ground for the analog signal and baseline voltage.
DGND: digital ground.

DAC0832 Experimental schematic:

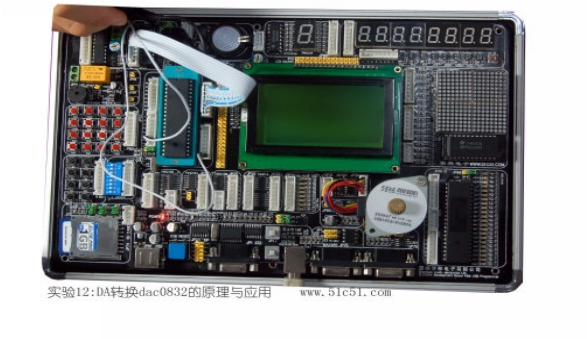


Reference: trapezoidal wave generated by DAC0832.

```
ORG 0080h
MAIN:     mov a,#0
MOV DPTR,#07FFFH
 MOV R1,#0ah
LP: MOVX @DPTR,A ;address selection
ACALL DELAY ;
djnz r1,next
sjmp main
next :
ADD A,#10 ;increase gradient of 19H
sjmp lp
DELAY:        ;
D2: MOV 31H,#0FFH
D1: DJNZ 31H,D1
RET
END
```

Connection methods:

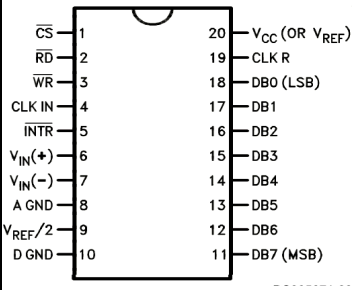
1. connect P3.6(JP53) of CPU to WR of DAC0832(JP24) with 1pin line
2. connect P2.7(JP52) of CPU to CS of DAC0832(JP24) with 1pin line
3. connect P0(JP51) of CPU to data input of of DAC0832(JP27) with 8pin line
4. observe the converted signal at J2 by an oscilloscope. Suggest adjust Y axis to 0.2V/cell, X axis to 1MS/cell.

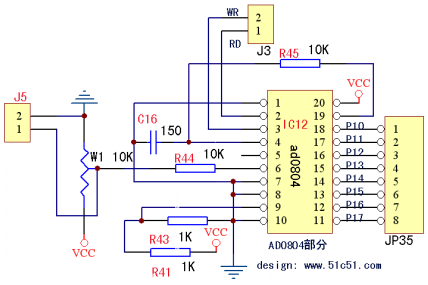


Oscilloscope waveform output photos:

Experiment 13: A / D converter ADC0804

The so-called A / D converter is the analog/digital converter (Analog to Digital Converter referred to as ADC) whose functionality is to convert analog signals into digital signals.

<table>
<tr>
<td> 

ADC0804 specifications and pin definitions</td>
<td> 
</td>
</tr>
<tr>
<td>/CS：chip select signal.
VREF：Auxiliary reference voltage.</td>
<td>/WR：Used to start the conversion of control. When /WR from HI to LO, the converters have been cleared; when /WR back to the HI, the conversion starts;</td>
</tr>
<tr>
<td>/RD：external converter to read the results of the foot control output signal.</td>
<td>DB0~DB7：8-bit digital output.</td>
</tr>
<tr>
<td>/INTR：Interrupt request signal output, low-level action</td>
<td>AGND，DGND：Analog and digital signal grounding</td>
</tr>
<tr>
<td>CLK IN，CLK R：Then the clock input or oscillation component (R, C), about restrictions on the frequency of 100KHz ~ 1460KHz</td>
<td>VIN（+），VIN（-）：Differential analog input voltage. Single-ended input voltage, VIN (-) grounding;</td>
</tr>
</table>

VCC: power supply, as a reference voltage of circuit.

voltage input and digital output relations for ADC0804 as shown in the table

Hex	Binary code	And the ratio of full scale		The relative value of the electricity should be VREF = 2.560 V	
		Four high-byte	Four low-byte	Four high-voltage bytes	The four l ow-voltage bytes
F	1111	15/16	15/256	4.800	0.300
E	1110	14/16	14/256	4.480	0.280
D	1101	13/16	13/256	4.160	0.260
C	1100	12/16	12/256	3.840	0.240
B	1011	11/16	11/256	3.520	0.220
A	1010	10/16	10/256	3.200	0.200
9	1001	9/16	9/256	2.880	0.180
8	1000	8/16	8/256	2.560	0.160
7	0111	7/16	7/256	2.240	0.140
6	0110	6/16	6/256	1.920	0.120
5	0101	5/16	5/256	1.600	0.100
4	0100	4/16	4/256	1.280	0.080

3	0011	3/16	3/256	0.960	0.060
2	0010	2/16	2/256	0.640	0.040
1	0001	1/16	1/256	0.320	0.020
0	0000			0	0

reference program

```
; ADC0804 reference program：
//define ADC PORT
ad_cs     equ P3.6
ad_wr     equ P2.0
ad_rd     equ P3.7
ad_input_port     equ p1
      org 0000h
      ajmp      main
      org 0080h
main:
      lcall adc_demo
      ajmp      main
;// start AD conversion
Adc_Start:
      clr ad_cs
      nop
      clr ad_wr
      nop
      setb      ad_wr
      nop
      setb      ad_cs
      nop
      ret
Adc_Read: ; //read converted signal
      mov ad_input_port,#0ffh
      clr ad_cs
      nop
      clr ad_rd
      nop
      nop
      mov a,AD_INPUT_PORT
      nop
      setb      ad_rd
      nop
      setb      ad_cs
      ret
;// show numbers read
Adc_Demo:
      lcall Adc_Start
      lcall delay1ms
      lcall adc_read
      clr p2.0
      clr p2.3
      mov p0,a
      ret
delay1ms:
      mov  r7,#10
tt1:
      mov  r6,#50
      djnz  r6,$          ;2us
      djnz  r7,tt1
      ret
      end
```

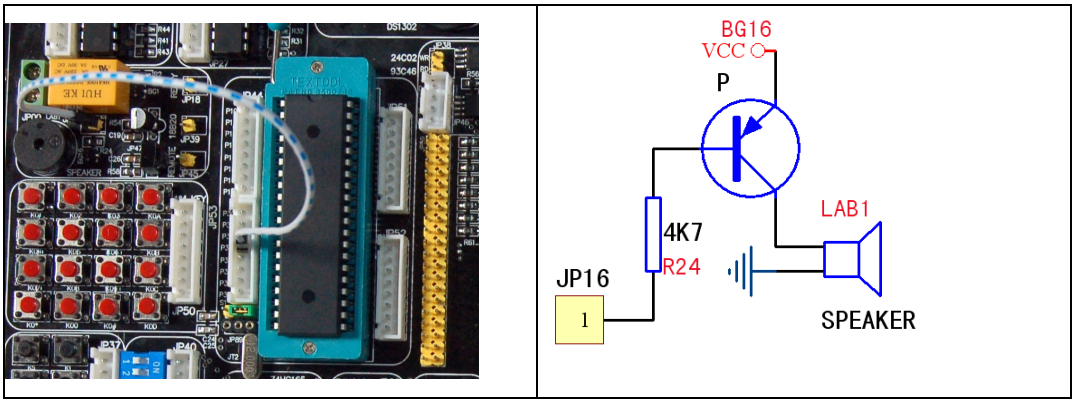
Connection methods:

1. connect P3.6/P3.7 port (JP53) of CPU to input of ADC0804(J3) with 2pin line.
2. connect P1 port(JP44) of CPU to data input of ADC0804(JP35) with 8pin line.
3. connect P0 port(JP51) of CPU to 8way indicators(JP32) with 8pin line.

Running photo, adjust ADJ3 with a small screwdriver, you can see the change on the 8way indicators.

Experiment 14: Small alarm bell experiment

Sound is generated by the vibration. Vibration of a certain frequency will generate a certain frequency of sound. The experiment is about generating a long and short alarm tick from speaker. Connection: connect P3.3 port(JP53) of CPU to input(JP16) of small speaker with 1pin line.



Reference program:

```
ORG 0080h
dlv: mov r2,#08h       ;1kz duration
dlv1:mov r3,#0fah
dlv2:cpl p3.3          ;1khz square-wave output
      lcall d5ms       ;Call Delay1
      djnz r3,dlv2     ;last for 1 second
      djnz r2,dlv1
      mov r2,#10h      ;2khz
Duration
dlv3:mov r3,#0fah
dlv4:cpl p3.3          ;2khz square-wave output
      lcall d25ms      ;Call delay2
      djnz r3,dlv4
      djnz r2,dlv3
      sjmp dlv         ;repeat
d5ms:mov r7,#0ffh     ;Delay subroutine 1
loop:nop
      nop
      djnz r7,loop
      ret
d25ms:mov r6,#0ffh      ;Delay subroutine 2
lin:djnz r6,lin
      ret
      End
```

Experiment 15: Infra-red remote control experiment

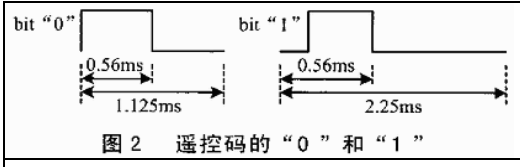
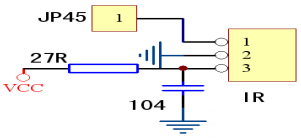


图 2 遥控码的“0”和“1”



XL2000 running photos

The decoding key is how to identify "0" and "1" from the place that we can find the definition of "0" and "1" are low to start the 0.56ms and the only difference is the width of the high, "0 "0.56ms," 1 "for 1.68ms, it must be based on the width of the high difference between" 0 "and" 1. " If 0.56ms from the low level after the delayed start, 0.56ms, if read in the lower level on the bit to "0", the contrary is "1", in order to reliable sake, have to delay more than 0.56 ms longer, but no more than 1.12ms, or if the "0", read the next is high, so check (1.12ms +0.56 ms) / 2 = 0.84ms the most reliable, General admission will be about 0.84ms.

The following experiments are based on the remote control button 1-16, the corresponding LED display 1-9,0, A, B, C, D, E, F.

Connection methods:

1. connect P0 port(JP51) of CPU to digital tube data port(JP5) with 8pin line.
2. connect P2 port(JP52) of CPU to digital tube display port(JP8) with 8pin line.
3. connect P3.7 port(JP53) of CPU to remote control input(JP45) with 1pin line.

```
        org 00h
        ORG 0080H
       MOV P1,#0FFH
        MOV P2,#0FFH
        MOV P3,#0FFH
START:
        JB P3.7,$ ; wait remote control signal
SB:
       MOV R4,#8    ;high TTL is wrong in 8ms
SBA:
       MOV R5,#250
SBB:
       JB P3.7,SXB1
       DJNZ R5,SBB
SXC:                        ;
       MOV R5,#5
SXC1:
       JB P3.7,SB3
       DJNZ R5,SXC1
       JMP START
SB3_1:
       MOV R5,#250
SB3_2:
       JNB P3.7,SB4
       DJNZ R5,SB3_2
       DJNZ R4,SB3_1
       JMP START
SB4:
```

```
    DJNZ R4,SBA
    MOV R4,#2
    JMP SBC
SXB1: MOV R5,#5
SXB2:               ;remove 20us disturb signal
    JNB P3.7,SBB
    DJNZ R5,SXB2
    JMP START
SBC:
    MOV R5,#250
SB1:
    JB P3.7,SB2     ;no high TTL is wrong in 2MS.
    DJNZ R5,SB1
    DJNZ R4,SBC
    JMP START
SB2:                ; remove 20us disturb signal
    MOV R5,#5
SB2_A:
    JNB P3.7,SB1
    DJNZ R5,SB2_A
    MOV R4,#3
SB2_1:
    MOV R5,#250
SB3:                ;
    JNB P3.7,SXC
    DJNZ R5,SB3
    DJNZ R4,SB2_1
    MOV R4,#2
    JMP SB3_1
```

```
    MOV R5,#5
SB4_1:
    JB P3.7,SB3_2
    DJNZ R5,SB4_1
     MOV R1,#1AH        ;
     MOV R2,#4
PP: MOV R3,#8
JJJJ:
    MOV R5,#250
JJJJ2:                  ;
    JB P3.7,JJJJ3
    DJNZ R5,JJJJ2
    JMP START
JJJJ3:
     LCALL YS1      ;
     MOV C,P3.7
     JNC UUU        ;
    MOV R5,#250
JJJJ4:
    JNB P3.7,UUU
    NOP
    DJNZ R5,JJJJ4
    JMP START
UUU:    MOV A,@R1   ;
     RRC A          ;
     MOV @R1,A      ;
     DJNZ R3,JJJJ   ;
     INC R1         ;
     DJNZ R2,PP     ;
```

```
;following recognize the code
     MOV A,1AH     ;compare high    8bit address
     XRL A,#00000000B ;
     JNZ EXIT ; decode error
     MOV A,1BH     ;compare low 8bit address
     XRL A,#11111111B ;retest high 8bit address
     JNZ EXIT ;decode error
     LCALL YS3
     MOV A,1CH     ;
     CPL A
     XRL A,1DH ;verify data
     JNZ EXIT ;decode error
     LCALL YS3
     CLR P2.6        ;select digital tube
     CLR P3.3 ;speaker beep
```

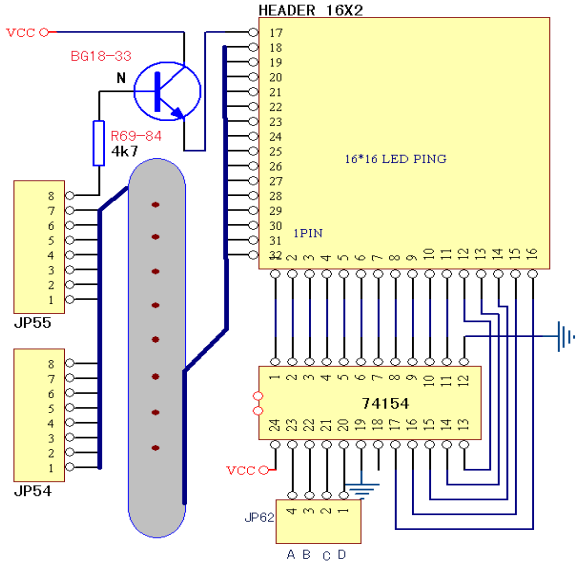
```
T4:  CJNE A,#09h,T5
     MOV P0,#61H                ;
T5:  CJNE A,#1dh,T6
     MOV P0,#21H                ;
T6:  CJNE A,#1fh,T7
     MOV P0,#7AH                ;
T7:   CJNE A,#0dh,T8
     MOV P0,#20H                ;
T8:  CJNE A,#19h,t9
     MOV P0,#60H                ;
 T9: CJNE A,#1bh,t10
     MOV P0,#28H                ;
 T10:    CJNE A,#11h,t11
     MOV P0,#30H                    ;
T11:     CJNE A,#15h,t12
```

```
        AJMP BIJIAO
;detect continuous code in 118MS
AA:   MOV R1,#25
XX:   ACALL YS2
        JNB P3.7,HH    ;
        DJNZ R1,XX
EXIT:       ;       AJMP START
;detect continuous code ----------
HH:   MOV R6,#4
S:      ACALL YS1      ;delay for 882US
        JB P3.7,EXIT    ;check if high TLL on P3.7
        DJNZ R6, S      ;repeat 4 times to confirm
        JNB P3.7, $     ;wait high TTL?
        LCALL YS3
        AJMP AA
BIJIAO:    MOV A,1CH     ;
        mov p1,a
        CJNE A,#10h,TT1
        MOV P0,#7EH                 ;display '1'
TT1:        CJNE A,#03h,T2
        MOV P0,#0A2H                ; display '2'
T2:   CJNE A,#01h,T3
        MOV P0,#62H                 ;
T3:   CJNE A,#06h,T4
MOV         P0,#74H                 ;
        MOV P0,#25H                 ;
T12:        CJNE A,#17h,t13
        MOV P0,#0a9H                ;
T13:        CJNE A,#12h,t14
        MOV P0,#26H                 ;
T14:        CJNE A,#16h,t15
        MOV P0,#0a1H                ;
 T15:       CJNE A,#4ch,t16
        MOV P0,#0b1H                ;
t16:  AJMP AA
YS1:  MOV R4,#20    ;delay subroutine1，882us
        D1: MOV R5,#20
        DJNZ R5,$
        DJNZ R4,D1
        RET
YS2: MOV R4,#10    ;delay subsourtine2，4740us
        D2: MOV R5,#235
        DJNZ R5,$
        DJNZ R4,D2
        RET
YS3: MOV R4,#2      ;delay subroutine3，1000us
        D3:MOV R5,#248
        DJNZ R5,$
        DJNZ R4,D3
        RET
        END
```

Experiment 16: Chinese characters display

Chinese character display is widely used in automobile stop and advertising screen. XL2000 experimental instrument has a standard 16 * 16 dot matrix display of Chinese characters. Its row scanning part is taken as P0, P2 port and column scanning consists of 4-16 decoder with 74LS154.

The circuit is as follows:



Connection methods:

1. connect P0 port(JP51) of CPU to JP55 of Chinese display with 8pin line.
2. connect P2 port(JP52) of CPU to JP54 of Chinese display with 8pin line.
3. connect P1.0~P1.3 port(JP44) to JP62 of Chinese display with 4pin line.

Reference program:

ORG 0080H	TABLE :
START: MOV A,#0FFH	db 01H,00H,02H,00H,04H,00H,1FH,0FFH;倚
MOV P0,A	db 0E2H,00H,22H,00H,22H,0FCH,26H,88H
ANL P2,#00	db 2AH,88H,0F2H,88H,2AH,0FAH,26H,01H

```
        MOV R2,#200
D1:     MOV R3,#248          ;delay
        DJNZ R3,$
        DJNZ R2,D1
        MOV 20H,#00H
l1:     MOV R1,#100
L2:     MOV R6,#16
        MOV R4,#00H
        MOV R0,20H
L3:     MOV A,R4
        MOV P1,A             ;
        INC R4
        MOV A,R0
        MOV DPTR,#TABLE
        MOVC A,@A+DPTR
        MOV P0,A             ;
        INC R0
        MOV A,R0
        MOV DPTR,#TABLE
        MOVC A,@A+DPTR
        MOV P2,A             ;
        INC R0
        MOV R3,#02
D2:     MOV R5,#248
        DJNZ R5,$
        DJNZ R3,D2
        MOV A,#00H
        MOV P0,A
        ANL P2,#00H
        DJNZ R6,L3
        DJNZ R1,L2
        MOV 20H,R0
        CJNE R0,#0FFH,L1     ;check if send
complete
        JMP START
```

```
db 63H,0FEH,26H,00H,02H,00H,00H,00H

db 02H,01H,42H,01H,42H,02H,42H,04H;天
db 42H,08H,42H,30H,42H,0C0H,7FH,00H
db 42H,0C0H,42H,30H,42H,08H,42H,04H
db 0C2H,02H,46H,03H,02H,02H,00H,00H

db 01H,00H,01H,00H,01H,00H,01H,00H;一
db 01H,00H,01H,00H,01H,00H,01H,00H
db 01H,00H,01H,00H,01H,00H,01H,00H
db 01H,00H,03H,00H,01H,00H,00H,00H

db 00H,00H,00H,7FH,3FH,02H,02H,02H;出
db 02H,02H,02H,02H,02H,02H,0FFH,0FEH
db 02H,02H,02H,02H,02H,02H,02H,02H
db 3FH,02H,00H,7FH,00H,00H,00H,00H

db 08H,00H,30H,02H,22H,02H,22H,42H;宝
db 22H,42H,22H,42H,0A2H,42H,63H,0FEH
db 22H,42H,22H,52H,22H,0DAH,26H,42H
db 22H,06H,28H,02H,30H,00H,00H,00H

db 00H,00H,20H,01H,20H,02H,20H,04H;刀
db 20H,18H,20H,60H,3FH,80H,20H,00H
db 20H,00H,20H,02H,20H,01H,20H,02H
db 7FH,0FCH,20H,00H,00H,00H,00H,00H

db 00H,02H,00H,0CH,7FH,0F4H,51H,08H;屠
db 55H,10H,55H,3FH,55H,6AH,5FH,0AAH
db 55H,2AH,57H,2AH,55H,2AH,59H,2AH
db 0F1H,7FH,43H,20H,01H,00H,00H,00H

db 08H,00H,08H,01H,08H,02H,08H,0CH;龙
db 08H,30H,09H,0C4H,0FEH,04H,08H,08H
db 0FH,0FCH,48H,22H,28H,42H,08H,82H
db 0BH,02H,18H,02H,08H,1EH,00H,00H
end
```

Experiment 17: 8155 experiment

8155 is an IC works as input and output RAM expansion. Characteristics are as follows: 256 bytes of RAM. A set of 6-bit programmable IO port. Two set of 8-bit programmable IO port. Programmable 14-bit binary counter/timing. Multiplexing address and data bus. Internal address latches. 40 pin dual in-line package, single +5 v power.	

Pin definitions:

PC3-- 1	ALE-- 11	21 --PA0	31 --PB2
PC4—2	AD0-- 12	22 --PA1	32 --PB3
TIMERIN-- 3	AD1-- 13	23 --PA2	33 --PB4
RESET—4	AD2-- 14	24 --PA3	34 --PB5
PC5—5	AD3-- 15	25 --PA4	35 --PB6
TIMEROUT—6	AD4-- 16	26 --PA5	36 --PB7
IO/M-- 7	AD5-- 17	27 --PA6	37 --PC0
CE/CE-- 8	AD6-- 18	28 --PA7	38 --PC1
RD-- 9	AD7-- 19	29 --PB0	39 --PC2
WR-- 10	VSS-- 20	30 --PB1	40 --VCC

Connection methods:

1. connect P0 port(JP51) of CPU to JP58 of 8155 part with 8pin line.
2. connect P3.4~P3.7 port(JP53) of CPU to JP63 of 8155 part with 4pin line.

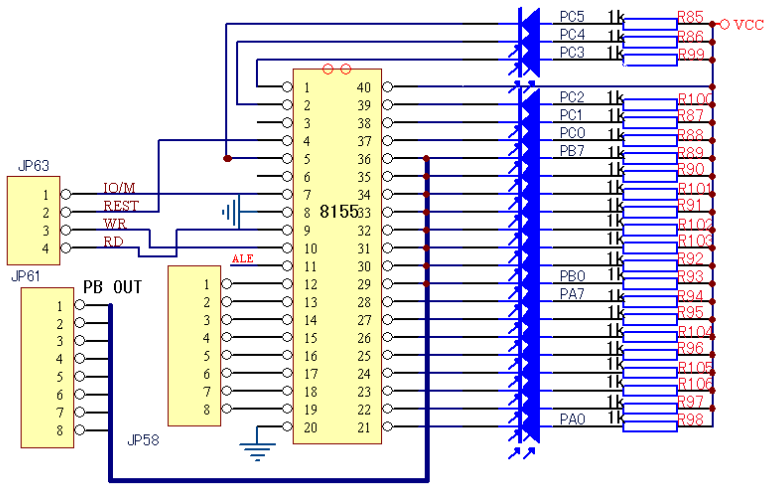
8155 experiment routine:

26way marqueen program with 8155 as IO extension.

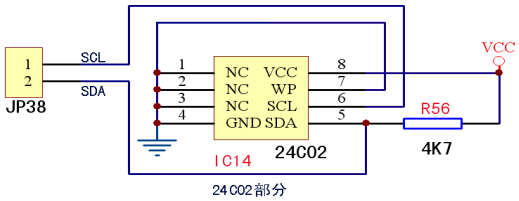
```
org 00h
JMP MAIN
ORG 0050H
MAIN:
MOV 08EH,#02H;    XRAM
clr p3.5 ;8155 reset
setb p3.5
clr p3.5
setb p3.4     ;8155 IO/M=1 selection
mov r1,#00h    ;command state register, 00H
mov a,#0fh ;set command state register with
A3: MOVX @R1,A
CALL DELAY
RL A
DJNZ R2,A3
MOV R1,#03H     ; PC address, 03H
MOV R2,#06H
MOV A,#0FEH
A4:MOVX @R1,A
CALL DELAY
RL A
DJNZ R2,A4
```

```
PA,PB,PC as output
movx @r1,a
a1:MOV R1,#01H   ;
MOV R2,#08H      ; shift left 8 times
MOV A,#0FEH      ;
A2:MOVX @R1,A    ;
CALL DELAY       ;
RL A             ;
DJNZ R2,A2   ;
MOV R1,#02H   ;   PB address, 02H
MOV R2,#08H
MOV A,#0FEH
JMP A1
 DELAY:
MOV   R7,#255
D1:MOV R6,#255
D2: DJNZ R6,D2
DJNZ R7,D1
RET
End
```

8155 Reference part of the schematic:



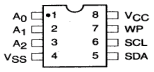
Experiment 18: experiment for 24C02 storing boot number



Connection methods:

1. connect P0 port(JP51) of CPU to data port(JP5) of digital tube with 8pin line.
2. connect P2 port(JP52) of CPU to display port(JP8) of digital tube with 8pin line.
3. connect P3.6/P3.7 port(JP53) of CPU to control end(JP38) of 24C02. You will see the number plus 1 at each press of reset.

管脚配置



管脚描述

管脚名称	功能
A0、A1、A2	器件地址选择
SDA	串行数据/地址
SCL	串行时钟
WP	写保护
Vcc	+1.8V～6.0V 工作电压
Vss	地

XL2000 running photos

```
  SDA24    EQU    P3.7
SCLK24 EQU    P3.6
    ORG    0000H
    AJMP   MAIN
    ORG 0080H
MAIN:CLR   P3.7      ;Open write protection
    MOV    DPTR,#TAB
    MOV    A,#00H        ;Reading address
        SETB SCLK24
         MOV C,SDA24
         MOV ACC.0,C
         CLR SCLK24
         DJNZ R7,RD000
         RET
WT24:    PUSH ACC;24C02 into process：
         SETB SDA24
```

```
    LCALL   RD24
    CJNE    A,#10,TT
TT: JNCTT1
    AJMP    TT2
TT1:    MOV     A,#00
TT2:    MOV     30H,A
    MOVC    A,@A+DPTR
    CLR     P2.6            ;Open LED
    MOV     P0,A            ;Sent to show
    MOV     A,30H
    INC A
    MOV     B,A
    MOV     A,#00H
    LCALL   WT24
    AJMP    $
TAB:DB
28H,7EH,0A2H,62H,74H,61H,21H,7AH,20H,
60H
RD24:   PUSH ACC ;Reading 24C02
subroutine.
        SETB SDA24
        CLR SCLK24
        CALL START24    ;Start
        MOV A,#0A0H
        CALL SHIFT8     ;Shift
        CALL ACK    ;Response
        POP ACC
        CALL SHIFT8
        CALL ACK
        CALL START24
        MOV A,#0A1H
        CALL SHIFT8
        CALL ACK
SETB SDA24
        MOV R7,#8
        CLR A
        SETB SDA24
  RD000:    RL A        ;8-bit
        CLR SCLK24
        CALL START24
        MOV A,#0A0H
        CALL SHIFT8
        CALL ACK
        POP ACC
        CALL SHIFT8
        CALL ACK
        MOV A,B
        CALL SHIFT8
        CALL ACK
        CALL STOP
        CALL DELAY2
        RET
START24:CLR SDA24;Conditions began to
        SETB SDA24
        SETB SCLK24
        CLR SDA24
        CLR SCLK24
        RET
STOP:    CLR SDA24;Stop condition
        SETB SCLK24
        SETB SDA24
        RET
ACK:     SETB SCLK24;Answer signal
        CLR SCLK24
        RET
SHIFT8: MOV R7,#8;Reading and writing
data
SH01:    RLC A
        MOV SDA24,C
        SETB SCLK24
        CLR SCLK24
        DJNZ R7,SH01
        RET
DELAY2:     NOP
END
```

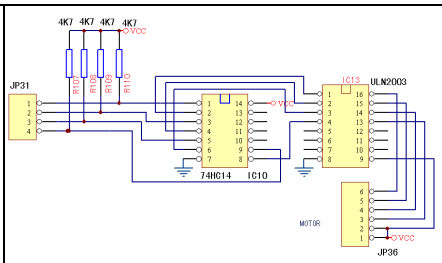
Experiment 19: Stepper motor experiment

Stepper motor is a kind of controlling component to convert pulse signal to angular displacement or line displacement. In the non-overloading situation, the motor speed and stopping location only depend on the frequency and the number of the pulse signals. It is not impacted by the load change.

The main characteristics of stepper motor:

1. Stepper motor must be driven with pulse signals. No pulse, no move. If asserted with proper pulse signal, it will rotate with a fixed angle. The speed is proportional with the frequency.
2. This step motor is configured with 7.5 degree/pulse. Rotating one lap needs 48 pulses.
3. Step motor has the advantage of rapid starting and stopping characters.

change pulse direction, you can change the direction of rotation.



XL2000 package adopts 12v stepping motor, in order to the convenience of demonstration, we provide it with a 5v power supply. The reader can provide it with 12v. The step motor is driven by uln2003, the port is P1.0~P1.3.

clockwise

	Steps	p1.0	p1.1	p1.2	p1.3
03h	1	1	1	0	0
09h	2	1	0	0	1
0ch	3	0	0	1	1
06h	4	0	1	1	0

Anti-clockwise

	Steps	p1.0	p1.1	p1.2	p1.3
03h	1	1	1	0	0
06h	2	0	1	1	0
0ch	3	0	0	1	1
09h	4	1	0	0	1

Connection methods:

Connect step motor port (JP31) to P1.0~P1.3 port with a 4pin line.

Reference program:

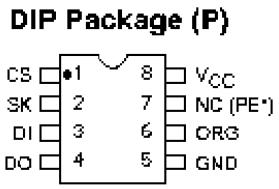
```
org 0080h
loop:mov R3,#0FFh        ; send -1 to 30h
main:INC R3
          mov a,R3
tt:       MOV     DPTR,#TAB
          MOVC  A,@A+DPTR
           MOV   P1,A    ;send content to display
          mov r7,#5
dec r7
           lcall delay              ;Delay
           cjne a,#06H,main      ;
ljmp loop      ;      Otherwise, clear R3
          ret
TAB: DB 03H,09H,0CH,06H ; stepper motor
 DELAY: ; Delay procedures
MOV   R5,#255
D3:MOV R2,#25
D4: DJNZ R2,D4
DJNZ R5,D3
RET
     end
```

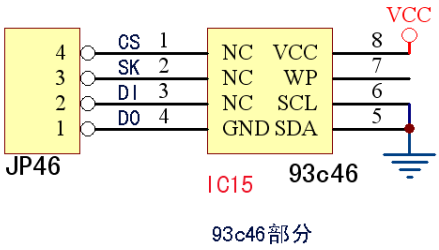
Experiment 20: 93c46 demo

Pin definitions and connecting graph:

管脚名称	功能
CS	片选信号
SK	时钟输入
DI	串行数据输入
DO	串行数据输出
Vcc	电源（+1.8 伏到 6 伏）
GND	接地
ORG	存储器结构选择
NC	不用连接
PE*	写入保护

Note: pin 6(org) is 16/8 mode selection, this pin is connected to GND for XL2000, so it can only work under 8bit mode.





93c46部分

93C46 running photos of the Marquee

Connection methods:

1. connect P3.4~P3.7 port(JP53) of the CPU to input port(JP46) of 93C46 with a 4pin line.
2. connect P2 port(JP52) to 8way indicators(JP32) with a 8 pin line.

This program sends 8way marquee data to 93C46 first, then reads and sends it to P2 port for display. Running this program, you can see 8 way marqueen. To show the role of 93C46, you can remove the connection line, and then no marqueen.

Reference program:

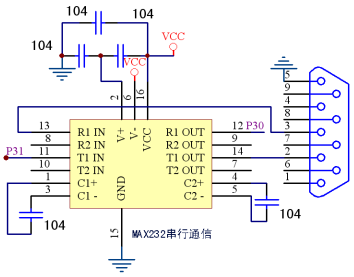
```
READ    EQU    0    ;Reading 93C46
WRITE   EQU    2    ;Write 93C46
EWEN    EQU    4    ; 93C46 write-enabled
EWDS    EQU    6 ; disable 93C46 writing
CS      BIT    P3.7 ;   93C46   CS
CLK     BIT    P3.6 ;   93C46 CLK
DI      BIT    P3.5 ;    93C46   DI
DO      BIT    P3.4   ;   93C46   DO
ADR46   EQU    20H
        ORG    00H
START0: MOV    21H,#00H;   Access code
CALL    SADR       ;
7 write the address (DI)            CALL
RDT46   ;Reading (DO), into 3CH
MOV     R4,A
        JMP     EX9346
SWRITE: MOV    A,#40H          ;Send opcode01
        CALL   SDATA
        MOV    A,ADR46     ;
93C46 included in the address              CALL
SADR          ;7 write the address
        MOV    A,R4        ;Write (3CH) data
```

```
address
            MOV     22H,#08H          ;   8 Group 8
yards
            MOV   P3,#10H
            MOV     ADR46,#00H   ;93C46 address
00H
START:   MOV
A,#EWEN              ;Write-enabled
            CALL   TO9346
            MOV     A ,21H            ;Access code
included in the guide
            MOV     DPTR,#TABLE ;TABLE to check
code
            MOVC   A,@A+DPTR
            MOV      R4,A        ;Deposit "into the
register"
            MOV      A,#WRITE         ;Write data
            CALL   TO9346
            MOV      A,#EWDS          ;Write to
prohibit
            CALL   TO9346
            INC      21H              ;1 yards off
            INC     ADR46             ;The next
address
            CALL      DELAY1
            DJNZ     22H,START
            MOV     R0,#30H ;51 into the RAM
address
            MOV     ADR46,#00H   93C46 :00
Address
            MOV     22H,#08H    ; 93C46 8 yards
A1:          MOV     A,#READ   ;Reading (address)
data
            CALL   TO9346
            MOV     A,R4 ;93C46 output data
included in the ACC
            MOV     @R0,A
            INC      ADR46           ;The next time
address
            INC      R0              ;The next RAM
            DJNZ   22H,A1
A2:        MOV   22H,#08H
            MOV   R0,#30H
OUTPUT:MOV   A,@R0
            CALL     SDT46
            JMP      EX9346
SEWEN:      CLR     A                ;
Opcode to send 00
            CALL   SDATA
            MOV   A,#60H;So that the code can be
written 11XXXXX
            CALL   SADR
            JMP     EX9346
SEWDS:      CLR     A                ;
Opcode to send 00
            CALL   SDATA
            CLR     A   ;7 write code to prohibit
operation 000XXXX
            CALL     SADR
EX9346:   CLR   CS                   ;CS=0
            RET
SADR:     CLR C
            RLC A
            MOV   R3,#7
            JMP   SD1
SDATA:   MOV   R3,#2
            JMP   SD1
SDT46:     MOV     R3,#8            ;Into the 8-bit
data
SD1:        RLC     A                ;
              MOV      DI,C
              SETB   CLK
              CALL     DELAY
              CLR      CLK
              CALL     DELAY
              DJNZ     R3,SD1
              RET
RDT46:     MOV      R3,#8           ;
Read out the 8-bit data
RD1:        SETB   CLK
              CALL     DELAY
              CLR      CLK
              CALL     DELAY
              MOV      C,DO
              RLC      A
              DJNZ     R3,RD1
              RET
 DELAY: MOV   R7,#0FH
```

```
        MOV   P2,A          ;Output to P2
        CALL  DELAY1        ;
        INC   R0
        DJNZ  22H,OUTPUT
        JMP   A2
TO9346: SETB  CS            ;93C46  CS=1
        SETB  DI            ;DI=1
        SETB  CLK           ;CLK=1
        CALL  DELAY         ;Start bit
        CLR   CLK           ;CLK=0
        CALL  DELAY
        MOV   DPTR,#JPTBL46
        JMP   @A+DPT ;A value of the jump in accordance with the relevant address
JPTBL46:    AJMP SREAD      ;Reading
        AJMP  SWRITE        ;Write
        AJMP  SEWEN         ;Write-enabled
        AJMP  SEWDS         ;Write to prohibit
SREAD:  MOV   A,#80H        ; Opcode to send 10
        CALL  SDATA
        MOV   A,ADR46 ;93C46 included in the address
        DJNZ  R7,$
RET
DELAY1: MOV   R4,#20
D1:     MOV   R5,#20
D2:     MOV   R6,#248
        DJNZ  R6,$
        DJNZ  R5,D2
        DJNZ  R4,D1
        RET
TABLE : DB    0FEH ,0FDH ,0FBH, 0F7H
;Ad a light to the left
        DB    0EFH ,0DFH ,0BFH, 7FH    ;
        END
```

Experiment 21: Two-way serial communication experiments

In simple applications, only 3 lines could complete the communication, namely the 2nd pin RXD, 3rd pin TXD, 5th pin GND. The interface between serial communication and the CPU: because serial communication specification defines “1” as +15V and “0” as -15V, while for CPU, “1” as 5V, “0” as 0V, the conversion between them is needed. The often seen conversion circuit is MAX232.



After the following program is OK and burned into the CPU, please close the burning functionality of XLISP software. And then press down JP17(programming/simulation) to simulation mode. Open sscomv20 serial port debugging tool in the CD, select COM port and set baud rate to 4800.

Connection methods:

1. connect P3 port(JP53) of CPU to keypad part(JP48) with a 8pin line.
2. connect P0 port(JP51) of CPU to data part(JP5) of digital tube with a 8pin line.
3. connect P2 port(JP52) of CPU to display port(JP8) of digital tube with a 8pin line.

Receive process: input “1” in the string input box and hit “send” button, the digital tube will show “1”.
Send process: press down K02~K05 of XL2000, you will see sscomv20 software receives 4 strings.
The process of receiving: Input string in a box, then "send" XL2000 digital display is a pipe. 2 shows that the importation of 2.

XL2000 receives “0” from PC

PC receives strings from XL2000

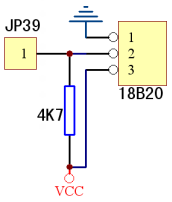
Reference program:

```
ORG 0000H
AJMP main0
ORG 0080H
main0: MOV 20H,#00H      ;Serial set up work
MOV TMOD,#22H
MOV SCON,#40H
MOV TH1,#0F3H      ;Rate setting 4800,
(12M Crystal)
MOV PCON,#80H
SETB TR1
SETB REN          ;Allowed to receive
clr p2.6          ;Open LED
ajmp start
start:
l1:jnb p3.3,l3        ;
Detection of the keyboard, then press the
implementation of the P3.3 If L3
jnb p3.4,l4
jnb p3.5,l5
JNB P3.2,L6
jbc ri,rec
mov p0,#0ffh
rec: mov a,sbuf          ;Data sent to a buffer
mov p1,a
CJNE  A,#00110001b,T00          ;Comparing
the received data
      MOV P0,#07eH              ;LED display1
 mov p0,#0ffh
t00: CJNE A,#00110010b,T2
      MOV  P0,#0A2H                    ;LED
display2
 mov p0,#0ffh
T2:  CJNE A,#00110011b,T3
      MOV P0,#62H
T3:  CJNE A,#00110100b,T4
MOV      P0,#74H
T4:  CJNE A,#00110101b,T5
      MOV P0,#61H
T5:  CJNE A,#00110110b,T6
      MOV P0,#21H
T6:  CJNE A,#00110111b,T7
      MOV P0,#7AH
T7:   CJNE A,#00111000b,T8
      MOV P0,#20H
T8:  CJNE A,#00111001b,t9
      MOV P0,#60H
T9: CJNE A,#00110000b,t10
MOV P0,#28H
t10:ljmp L1
l3:   mov dptr,#ok1      ;Table head home1
      ajmp      senda3
senda3: clr a ;
      movc a,@a+dptr
      cjne a,#'$',senda_3
      ajmp start    ;$ Encountered in the
implementation is to start from scratch.
senda_3:mov sbuf,a    ;Send data
      JNB TI,$;
      CLR TI ;
      inc dptr
      Ljmp senda3
l4:   mov dptr,#ok2      ;Table head home2
      ajmp      senda3
l5:   mov dptr,#ok3      ;Table head home3
      ajmp      senda3
l6:   mov dptr,#ok4      ;Table head home4
      ajmp      senda3
ok1:  db  0dh,0ah,0dh,0ah,"You  press  the
button p3.2",0dh,0ah,'$'
ok2:  db  0dh,0ah,0dh,0ah,"You  press  the
button p3.3",0dh,0ah,'$'
ok3:  db  0dh,0ah,0dh,0ah,"You  press  the
button p3.4",0dh,0ah,'$'
ok4:  db  0dh,0ah,0dh,0ah,"You  press  the
button p3.5",0dh,0ah,'$'
end
```

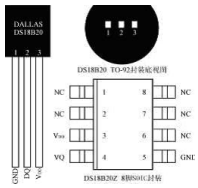
Experiment 22: 18B20 digital temperature display system (Limited to XL2000) XL600+ needs extra purchase of the chip

To complete controlling of temperature conversion with DS18B20, it is necessary to go through three steps: initialization, ROM operating commands and memory operating commands. First, DS18B20 needs to be started. And then the temperature conversion value is read out. This program is hooked only one chip, using default 12bit conversion precision, external power supply, the high byte value of the temperature is sent to WDMSB, low byte value to WDLSB. Finally, the actual temperature value is converted according to the temperature format.

circuit schematic of 18B20



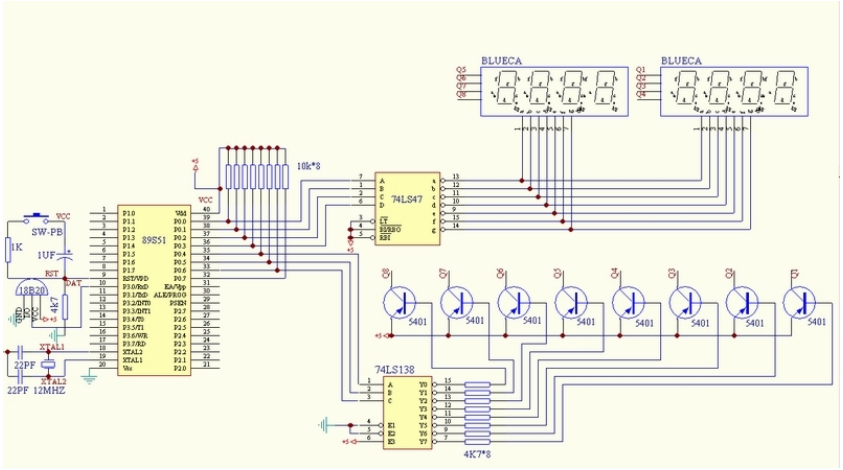
package and pin definitions of 18B20



Running program and the digital tubes will show the current temperature.

In this system: In order to simplify the program, 74LS47 (LED decoding) and 74LS138 (3-8 decoding) are adopted. That's to say, P0.0, P0.1, P0.2 and P0.3 are connected to 74LS47, then the output are connected to data port (JP5) of the digital tube. P0.4~P0.6 are connected to 74LS138, and the output connected to bit control(J8) of the digital tube.

Integrated system schematic:



Reference program:

```
DAT     BIT P3.0                ;Data Communication I
WDLSB DATA 30H          ;Read out the low-temperature bytes
WDMSB DATA 31H          ;Read out the high-temperature bytes
        ORG 0000H
        LJMP MAIN
        ORG 000BH
        SJMP TIMER0             ; Show time
;Subroutine show from time to time, the cycle of scanning; show the buffer zone 40H~47H
          ORG 0040H
TIMER0:
    MOV P0,40H          ;To send Finally, a value p0
    ORL P0,#70H; Finally, a light
    CALL T1MS
    MOV P0,41H
    ORL P0,#60H
    CALL T1MS
    MOV P0,42H
    ORL P0,#50H
    CALL T1MS
    MOV P0,43H
    ORL P0,#40H
    MOV TH0,#LOW(65536-10000)   ; 10MS timer interrupt
    MOV TL0,#HIGH(65536-10000)
    RETI
T1MS: mov   r5,#00h         ;Delay subroutine
tt:   mov r6,#9
    djnz r6,$
    djnz r5,tt
    ret
;************************** *****;Main program:
MAIN:   MOV SP,#60H
    MOV P2,#0FFH
    MOV R2,#8
SS2:    MOV 49H,#255
SS1:    MOV 4AH,#255
SS0:    DJNZ 4AH,SS0
    DJNZ 49H,SS1
    DJNZ 48H,SS2
    MOV P1,#11111100B
    CLR EA
    LCALL RST
    JNB F0,KEND
    MOV R0,#0CCH            ;Skip ROM match
    LCALL SEND_BYTE
    MOV R0,#0BEH            ; Reading an order issued by the temperature
    LCALL SEND_BYTE
    LCALL READ_BYTE
    MOV WDLSB,A
    LCALL READ_BYTE
    MOV WDMSB,A
    LCALL TRANS12
KEND:   mov p1,#01010101b
    SETB EA
    RET
;**************************************
;Temperature conversion process: the precise：0.06 ;
TRANS12:MOV A,30H
    ANL A,#0F0H
    MOV 3AH,A
    MOV A,31H
    ANL A,#0FH
    ORL A,3AH
    SWAP A
    MOV B,#10
    DIV AB
    MOV 43H,A
    MOV 42H,B ;
    MOV DPTR,#TABB
    MOV A,30H
    ANL A,#0FH
    MOV B,#2
```

```
    MOV R0,#40H ;
OVER:   MOV @R0,#00H
        INC R0
    DJNZ R2,OVER
    MOV TMOD,#01H
    MOV TH0,#LOW(65536-10000)
    MOV TL0,#HIGH(65536-10000)
    SETB EA
    SETB ET0
    SETB TR0
LOOP:   LCALL DSWD ;DS18B20 call to read out the temperature program
    SJMP LOOP
                ; DS18B20 temperature readout process
DSWD:
    CLR EA
    LCALL RST
    JNB F0,KEND         ;If there is no response, to return to the main program
    MOV R0,#0CCH
    LCALL SEND_BYTE     ; Skip ROM match
    MOV R0,#44H         ;Temperature conversion to issue an order
    LCALL SEND_BYTE
    SETB EA
    MOV P1,#00001111B
    MOV 48H,#1          ;Ting 75ms when more than ready to read
    MUL AB
    MOVC A,@A+DPTR
    MOV 41H,A
    MOV A,30H
    ANL A,#0FH
    MOV B,#2
    MUL AB
    INC A
    MOVC A,@A+DPTR
    MOV 40H,A
    RET
TABB:DB 0,0,0,6,1,2,1,8,2,5,3,1,3,7,4,3,5,0
    DB 5,6,6,2,6,8,7,5,8,1,8,7,9,3
;*********************************
SEND_BYTE:          ; Send a byte program
    MOV A,R0
    MOV R5,#8
SEN3:   CLR C
    RRC A
JC SEN1
```

```
    LCALL WRITE_0
    SJMP SEN2
SEN1:   LCALL WRITE_1
SEN2:   DJNZ R5,SEN3    ; 8 cycle times, to write a byte
    RET
READ_BYTE:          ;Reading a byte program
    MOV R5,#8
READ1:  LCALL READ
    RRC A
    DJNZ R5,READ1       ; 8 cycle times,
WRITE_0:            ;Write 0
        CLR DAT
    MOV R6,#30
    DJNZ R6,$
    SETB DAT
    RET
WRITE_1:CLR DAT         ; write 1
    NOP
    NOP
    NOP
    NOP
    NOP
```

```
reading a byte
    MOV R0,A
    RET
;Reset process, if the location of the complex-F0, did not reset F0
RST:    SETB  DAT
    NOP
    NOP
    CLR DAT
    MOV R6,#250          ;Host-fat reduction and pulse duration
3μs×200=600μs
    DJNZ R6,$
    MOV R6,#50
    DJNZ R6,$
    SETB DAT       ;The release of the host bus, I changed line input
    MOV R6,#15
    DJNZ R6,$
    CALL CHCK ;Call response inspection procedures
    MOV R6,#60
    DJNZ R6,$
    SETB DAT
    RET
CHCK:  MOV C,DAT
    JC RST0
    SETB F0       ;Signal was detected, Chi-F0
    SJMP      CHCK0
RST0:  CLR F0    ;F0 is not ready to reset
CHCK0:  RET
    SETB DAT
    MOV R6,#30
    DJNZ R6,$
    RET
;A reading of the data program
READ:  SETB DAT    ;1US have a reset signal the start time
    NOP
    NOP
    CLR DAT
    NOP
    NOP
    SETB DAT         ;
DAT-home prepared to receive data NOP
    NOP
    NOP
    NOP
    NOP
    NOP
    MOV C,DAT
    MOV R6,#23
    DJNZ R6,$
    RET
    END
```

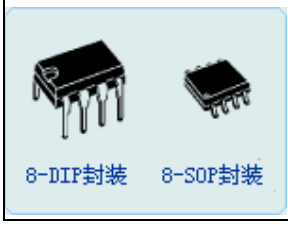
This procedure measuring temperature range: from 0 to 125 degree, resolution 0.06 degree;

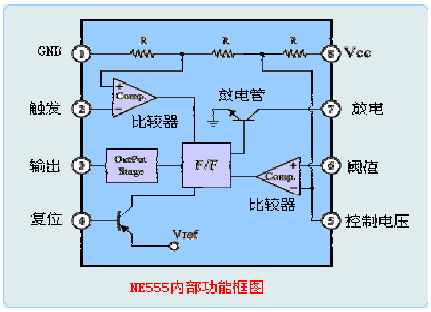
Connect methods:

1. connect JP39 of 18B20 to P3.0 port(JP53) of the CPU with a 1pin line.
2. connect decoding part(JP19) of digital tube to P0.0~P0.3 port(JP51) of the CPU with a 4pin line.
3. connect decoding output(JP88) of digital tube to data port(JP5) of the digital tube with a 8pin line.
4. connect 3-8 decoding part(JP22) to P0.4~P0.7 port(JP51) of the CPU with a 4pin line.
5. connect 3-8 decoding output(JP25) to display port(JP8) of the digital tube.

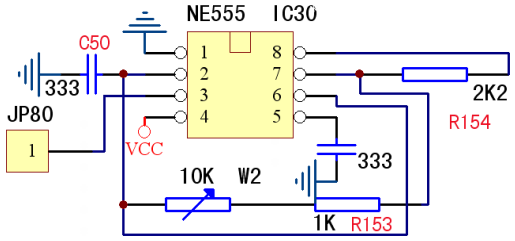
Experiment 23: NE555 hardware oscillator counter experiment

The NE555 Package





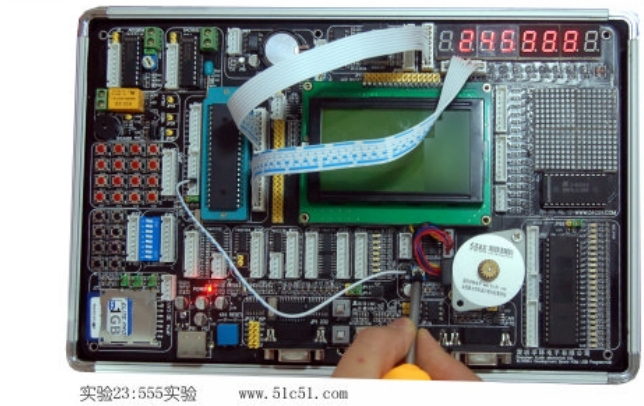
Internal function block diagram



NE555 component can be used in a lot of application circuit, and even up to hundreds of application circuit, in all types of books are introduced, such as home appliance control, doorbell, alarm, signal generator, circuit testing equipment, components Meter, timer, the VFC circuit, power circuit applications, automatic control devices and other applications circuits are widely used because of NE555 cleverly analog circuits and digital circuits together because. During the plane in the formation of a hardware oscillator by regulating the output frequency W2. JP80 by output, can single-chip
Experimental do count.

Connection methods:

1. connect data port (JP5) of digital tube to P0 port(JP51) of the CPU with a 8pin line.
2. connect display port(JP8) of digital tbue to P2 port(JP52) of the CPU with a 8pin line.
3. connect JP80 of NE555 to P3.5 of the CPU with a 1pin line.



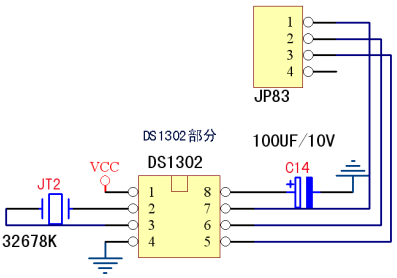
Reference program:

```
a_bit equ 20h            ;000-bit register
    b_bit equ 21h        ;10 Register
    c_bit equ 22h        ;100 Register
    d_bit equ 23h
    e_bit equ 24h
    f_bit equ 25h
org 0000h
    ajmp star
    org 0080h
    star:                ;Initialization of all the All-Clear
        mov a,#00h
        mov a_bit,a
        mov b_bit,a
        mov c_bit,a
        mov d_bit,a
        mov e_bit,a
        mov f_bit,a
stlop:  acall display    ;Call display
    jb p3.5,stlop        ;Monitoring keyboard, then press the implementation of the show p3.2
we:     acall display    ;Maintaining the show!
    acall d1ms           ;
1ms delay to avoid a keyboard malfunction
    jnb p3.5,we          ;P3.2 if not continue to delay opening
count:                   ;Part of the calculations
display:                 ;Show
        mov dptr,#numtab ;Send data sheets
mov a,a_bit              ;To send 000-bit data
        MOVC A,@A+DPTR   ;Look-up table
        mov p0,a         ;I send p0 show
        clr p2.6         ;Select the first digital control
        acall d1ms       ;Show 1ms
        setb p2.6        ;Show to close
mov a,b_bit              ;10 to send data
        MOVC A,@A+DPTR   ; Look-up table
        mov p0,a         ;I send p0 show
        clr p2.5         ;Select the second digital control
    acall d1ms           ;Show 1ms
        setb p2.5        ;Show to close
mov a,c_bit
        MOVC A,@A+DPTR
        mov p0,a
        clr p2.4
        acall d1ms
        setb p2.4
mov a,d_bit
        MOVC A,@A+DPTR
        mov p0,a
        clr p2.3
        acall d1ms
```

```
    inc a_bit       ;000-plus 1
    mov a,a_bit
    cjne a,#10,stlop    ;If less than 10 show
    mov a_bit,#00h          ;If the removal of
10
    inc b_bit           ;10 plus 1
    mov a,b_bit
    cjne a,#10,stlop        ;If less than 10
show
    mov b_bit,#00h          ;If the removal of
10
    inc c_bit               ;100 plus 1
    mov a,c_bit
    cjne a,#10,stlop
    mov c_bit,#00h
    inc d_bit
    mov a,d_bit
    cjne a,#10,stlop
    mov d_bit,#00h
    inc e_bit
    mov a,e_bit
    cjne a,#10,stlop
    mov e_bit,#00h
    inc f_bit
    mov a,f_bit
    cjne a,#10,stlop
    mov f_bit,#00h
    ajmp stlop
```

```
    setb p2.3
mov a,e_bit
    MOVC A,@A+DPTR
    mov p0,a
    clr p2.2
    acall d1ms
    setb p2.2
mov a,f_bit
    MOVC A,@A+DPTR
    mov p0,a
    clr p2.1
    acall d1ms
    setb p2.1
    ret
D1MS:                   ;LED Delay
    MOV R7,#2
    DJNZ R7,$
    RET
            ;LED code table
numtab:                                 db
28h,7eh,0a2h,62h,74h,61h,21h,7ah,20h,60h
    ;0 1 2 3 4 5 6 7 8 9
    end
```

Experiment 24: DS1302 real-time clock experiment



The DS1302 schematic

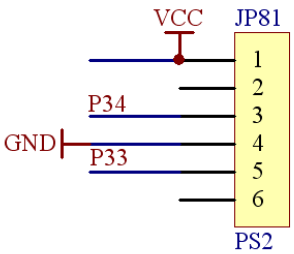
Connection methods:

1. connect keypad part(JP37) to P1.4~P1.7 port(JP44) of the CPU with a 4pin line.
2. connect data port(JP5) of the digital tube to P0 port(JP51) of the CPU with a 8pin line.
3. connect display port(JP8) of the digital tube to P2 port(JP52) of the CPU with a 8pin line.
4. connect speaker part(JP16) to P3.3 port of the CPU with a 1pin line.
5. connect relay part(JP18) to P3.5 port of the CPU with a 1pin line.
6. connect DS1302 part(JP83) to P1.0~P1.3 port(JP44) of the CPU with a 4pin line.

Please refer to the experimental program in the CD.

Experiment 25: PS2 keyboard experiment

Please refer to CD about how to programming with PS2 keyboard.



PS2 Keyboard hardware schematics, pin 3, pin 5 have been connected to P3.4, P3.3 of the CPU.

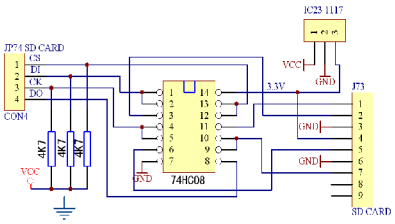
PS2 experimental photo: insert standard PC keyboard with PS2 interface into JP81 of XL2000. Insert all the jumper caps on JP41. Once you press down one key, the character will show on the LCD. (When doing other cases without LCD, please remove all the jumper caps on JP41)

Experiment 26: SD card SPI mode experiment

SD card, with full name as Secure Digital Memory Card, has the advantage of lightweight, encryption, high-speed transmission and good for handhold devices. SD works under high speed and low speed modes, therefore designed with two interfaces SD mode(high speed) and SPI interface(low speed). In the single chip application, it often works with SPI interface

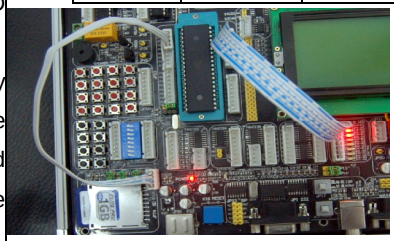
Class0 :(basic command set like card identification, initialization)
CMD0:Reset SD card.
CMD1:Reading OCR register.
CMD9:Reading of the CSD register.
CMD10:Reading CID register.
CMD12:Stop reading when the multi-block data transfer
CMD13:Reading Card_Status Register
Class2 (Reader-command):
CMD16:Set the length of the block
CMD17:Reading a single block.
CMD18:Read more block until the host CMD12 so far
Class4(Write-card orders):
CMD24:Write a single block.
CMD25:Write more blocks.

CMD27:CSD register to write.
Class5 (Erase-card orders):
CMD32:Erase set the starting block address.
CMD33:Set erase the termination of the address block.
CMD38: Erase the chosen block.
Class6(Write-protection orders):
CMD28:Set to write the protection of the address block.
CMD29:Erase the address block write protection.
CMD30: Ask the card for the status of the write protection bits
class7： The card lock, unlock the function of command set
class8：Application-specific commands.
class10 －11 ： Reservations
One class1, class3, class9: SPI mode does not support



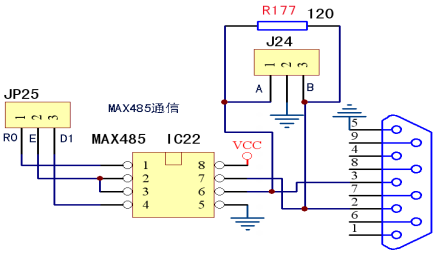
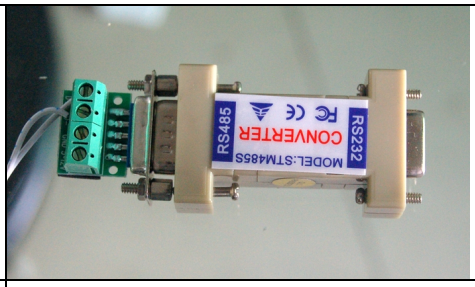
Connection methods:
1. connect SD card part(JP74) to P1.0~P1.3 port(JP44) of the CPU with a 8pin line.
2. connect power line of SD card to the 5V and GND of the XL2000 board with 2 1pin lines.
3. connect P0 port(JP52) of the CPU to 8way indicators(JP32) with a 8pin line. Please refer to the SD card program in the CD, burn it into the CPU and you will see 8way marqueen. Remove SD card, the marqueen stops.

SD 引脚	SD 模式	SPI 模式
1	DAT3	CS
2	CMD	DI
3	VSS	VSS
4	VDD	VDD
5	CLK	SCLK
6	VSS	VSS
7	DAT0	DO
8	DAT1	Resvered
9	DAT2	Resvered



Experiment 27: 485 communication experiment

RS-232 has exposed advantages of low transmission speed, short transmission distance and high signal disturbance at the interface in the modern communications. The transmission distance of RS-485 could reach 1200m.

<table>
<tr>
<td> 
</td>
<td> 
</td>
</tr>
<tr>
<td>max485 schematic</td>
<td>This experiment needs RS-232C/RS-485 adaptor.
This component is not in the package and need extra payment for it.</td>
</tr>
</table>

Hardware connection: connect RO pin of MAX485 to the serial receiving pin RXD P3.0 of the CPU, DI pin of MAX485 to TXD pin P3.1 of CPU. Because of half-duplex communication mode, we can not send and receive message simultaneously. We can only control the state of RE/DE pin to switch receiving and sending. Here we connect RE and DE pin together, when assert low voltage on it, MAX485 is on receiving state, when high voltage(+5V), MAX485 is on sending state. From software perspective, RS232 is same as MAX485. Please refer to the CD for the reference program.

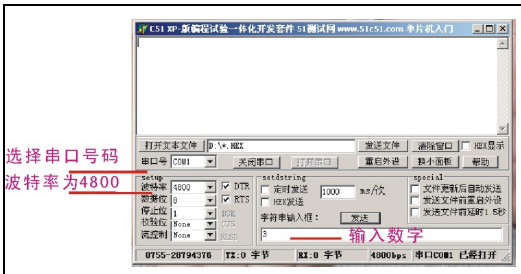
Testing methods:
When the program MAX485.HEX is burned into chip, please close the xlisp software. Press down JP17(programming/simulation) to simulation mode. Open serial debugging tool sscomv20 in the CD. Select the COM port(usually COM1), and set baud rate as 4800.

Connection methods:

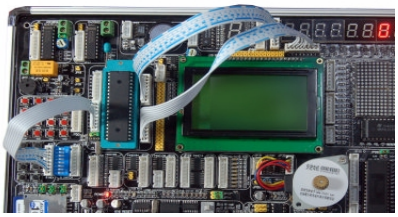
1. connect keypad part(JP37) to P3 port(JP53) of the CPU with a 8pin line.
2. connect data port(JP5) of the digital tube to P0 port(JP51) of the CPU with a 8pin line.
3. connect display port(JP8) of the digital tube to P2 port(JP52) of the CPU with a 8pin line.
4. connect R0 of MAX485 to P3.0, DI to P3.1 with 2 1-pin lines,
5. connect PC serial port with MAX485 adaptor.
6. connect D+/D- of MAX485 adaptor to MAX485 port(A, B) on the board with 2 1-pin lines.

1PIN with a line connecting the MAX485 development board E (control is RE, DE) were

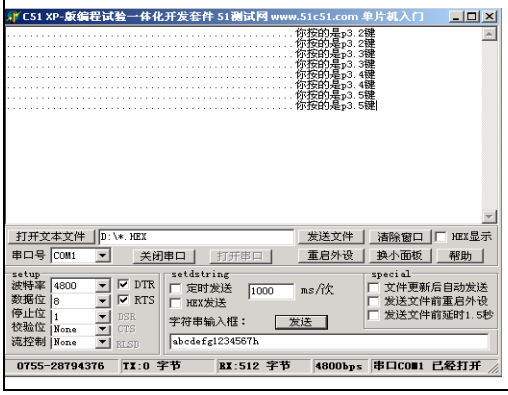
grounded, and 5V respectively, to be accepted by sending the experiment



Receiving process: input “1” in the string input box and hit “send” button. We can see the digital tube displays “1”.



Send “0” in the string input box and show “0” in a digital tube.

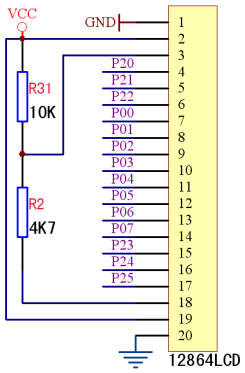


Send process: press down K02~K05 four keys, we can see 4 strings shown on the receiving window of the serial debugging tool.

Experiment 28: A liquid crystal display screen 12864

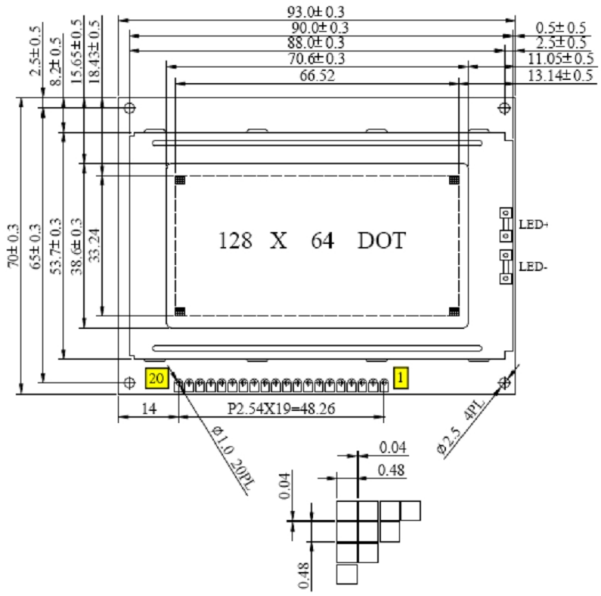
Pin NO.	Symbol	Level	Functi
1	VSS	0V	Power Gr
2	VDD	+5V	Power su
3	VO	--	For LCD drive volt
4	D/I	H/L	H: Display Data, L:Dis
5	R/W	H/L	H: Read Signal, L:
6	E		Enable Si
7-14	DB0-DB7	H/L	Date b
15	CSA	H/L	Select c
16	CSB	H/L	Select c
17	/RES	H/L	Reset Si
18	VEE	-15V	Negative voltage
19	LED(+)	--	Power (+)for LE
20	LED(-)	--	Power (-)for LE

12864 of the schematic wiring: 15 jumper caps to control access not



In this package, all of the pins have been connected with CPU already. You can control the 15 jumpers to decide if the LCD is active in circuit. If you want to activate LCD, then the 15 jumpers should be closed, else keep them open to avoid disturbance. W3 is used to adjust the contrast.

12864LCD mechanical size chart:



the definition of 12864 LCD pin

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
VSS	VDD	VO	D/I	R/W	E	DB0	DB1	DB2	DB3	DB4	DB5	DB6	DB7	PSB	NC	RSTB	NC	BLA	BLK

Reference: show letter A on the LCD.

```
RS EQU P2.0
      RW EQU P2.1
      E EQU P2.2
      ORG 0080H
      MOV P0,#00000001B ;Clear display
      ACALL ENABLE
      MOV P0,#00000001B ;Clear display
      ACALL ENABLE
      MOV P0,#00111000B ;Display
       ACALL ENABLE
      MOV P0,#00001111B ;Display control
switch
      ACALL ENABLE
      MOV P0,#00000110B ;Input mode
      ACALL ENABLE
      MOV P0,#0C0H ;Data memory
address
      ACALL ENABLE
      mov p0,#01000001b ;ASCII Code
SETB RS
      CLR RW
      CLR E
      ACALL DELAY
      SETB E
      AJMP $
ENABLE: CLR RS ;Send orders
      CLR RW
      CLR E
      ACALL DELAY
      SETB E
      RET
DELAY: MOV P0,#0FFH
      CLR RS
      SETB RW
      CLR E
      NOP
      SETB E
      JB P0.7,DELAY ;detect busy
      RET
      END
```

XL2000 running photo, (after the completion of the experiment, please remove all the JP41 jumpers)

The effect of running 12864ZIKU.HEX in the CD.

Chapter VII Frequently Asked Questions

If you are a beginner, then I strongly recommend that you carefully read the following. When you have something wrong in the experiment, you can get back here anytime to have a review.

1 Why my XL2000 programming package is always displaying: the selected serial port does no exist, please choose another one?

a. Check if power is on, and power indicator light is on.

b. Check if programming/simulation switch button is set at the correct state. The button state must be on when do programming.

c. Check if any other software occupies serial port, such as other programmer, debugger or keil uv2 simulation software. The same serial port can only support one program at the same time, else confliction exists.

d. Check if serial port selection is OK. You can open Control Panel/System/Hardware property /serial ports and see the port number. Make sure the selection is consistent with the allocation number.

e. Check if the USB drive is installed correctly. (Refer to Chapter III: USB Installation Guide)

f. Check if USB/RS232 jumper is OK, if you use USB, then JP13/JP14 must set to USB.

2. Why XL2000 does not act after prompted with success programming and target board is running?

a. Check if the chip on the board socket is 89S51. Other chip does not work.

b. Check if the serial port is connected correctly with pin lines. The result can only be displayed on some experimental resources such as LCD/LED. This output resources should be connected to CPU output port by pin lines correctly.

c. Check if the system is reset well. You can have a try to press down the RESET button.

3. In simulation mode, why the board cannot connect to my PC?

a. Check if the simulation module in the package is locked well on the socket.

b. Check if keil uv2 software version is OK. Strongly suggest using the keil uv2 software in the package shipped to you. (Some other versions keil is not compatible.) Attention: the keil software must be installed under the root of c disk, which means c:\. Other directory does not work. (Refer to Chapter V, XL2000 simulating operation guide). The file must be named ascii and placed under ascii folder.

c. Check if the COM port configuration is OK. Because simulation and programming are both using COM ports, when doing simulation, other software that is using COM port must be closed.

d. Check if programming /simulation button state is OK. (down button means simulation)

4. Why the simulation head works well with on board resources but does not work with external board?

a. Check if the external board is reset well, the oscillator is OK and the programming functionality is OK of the board?

b. Check if the simulation head is plugged correctly. The first PIN(red) must be connected to the first PIN of the CPU. You can verify it with a multi-meter.

5. Why some program works under programming mode, but not in simulation mode?

In the simulation mode, some system resources are occupied to support the simulation functionality. The situation is not 100% same as the real programming running environment. If you have doubts about the simulation result, then please switch to ISP programming mode. Under normal circumstances, I suggest the use of programming–experiment mode.

6. How to do if I want to use 2051 single chip?

Compared with 89S51 chip, 2051 is only lack of p0 and p2 port. The programming model and the instructions are both the same. So you can use 2051 chip as your wish only need to pay attention to avoiding the use of p0 and p2 port. If you must use 2051, then we can offer you other programmers with a discount.

7. Is 89S52 totally same as 89C51?

89S52 is an upgrade version of 89C51 and their instruction set is completely compatible, and can substitute for each other. Compared with 89C51, 89S52 has the advantage of lower price and longer life expectancy. At the same time, 89S52 is configured with the watchdog and ISP downloading functionality.

Chapter VIII: System configuration and post-sale service guide

Standard configuration: (this configuration changes according to different situations)

- XL2000: an integrated single-chip simulation/programming instrument (100% test OK, on-board configured with a piece of 89s52 and 12864 LCD)
- one backup 89s52 chip
- one simulation module
- one serial communication cable
- one USB cable
- ultra-thin infrared remote controller HT6221
- 40PIN simulation head/cap
- 10PIN ISP downloading head/cap
- 15 pieces of connecting pin line
- one manual (this handbook)
- one software CD (drivers, software tools, example sources, single-chip document and tutorial.)

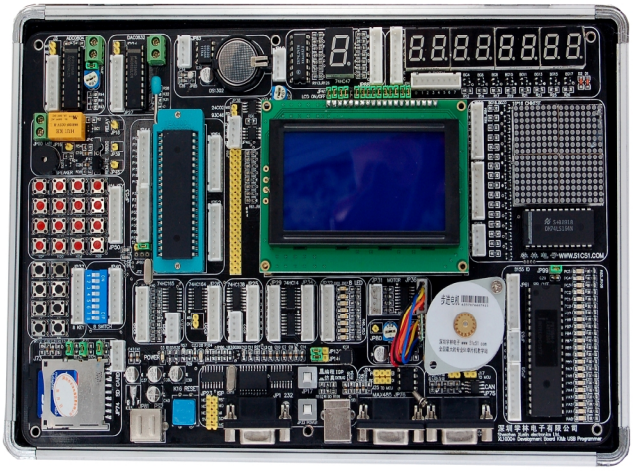
Warranty:

In the absence of self-repair demolition cases, the products sold from the three months from the date OZ free of charge for three years free warranty. (Experimental chip, with the exception of LCD) with the customer directly to the company or agent to replace.

Technical support:

Any user of this product, go to the latest forum http://www.8951.com/bbs/index.asp and register an account for getting more help and more sources! In the forum, at any time, dozens of friends are ready to share with you the joy of learning!

For more information and source, click www.8951.com www.51c51.com
Technical Forum: http://www.8951.com/bbs/index.asp



User Survey Card

Dear users, please fill out the following information carefully, after the self-scan or sent to the mailbox owner SXJ1974@163.COM
(We will recover the user's card users randomly selected 10% of the gift attractive prizes. Thank you for your support!)
Your name:_____
Your Address:_____
Your telephone:_____
Product Name: XL2000 integrated simulation experiment instrument
Date of purchase:
What do you think of our products:
And the appearance of the process:
□ Well □ General □ Bad
System resources:
□ Strong □ General □ Weak
Where should be improved for our products:
_____
_____
_____

From what we know means (choose) □ Dian zi Newspaper □ Radio □ E-World □ Search engine □ Links to other sites □ A friend □ E-market

Your Education: □ Secondary or high school □ Big or college □ Graduate and above
Your Occupation: □ Students □ Teacher □ Hardware Engineers □ Software Engineer □ Fans
The average monthly income:
□ 1000 and the following □ 1000-3000
□ 3000-5000 □ 5000-10000
Your comments and suggestions about the product:

_____
_____

Shenzhen, Xuelin Electronics Co., Ltd, China. All rights reserved September 3, 2008 Wednesday The third edition